# Module Handbook
# Chemical and Process Engineering Bachelor 2015 (Bachelor of Science (B.Sc.))

SPO 2015
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** | 2015 |
| **Regular semesters** | 6 semesters |
| **Maximum semesters** | 12 semesters |
| **Credits** | 180 |
| **Language** | German |
| **Grade calculation** | Weighted by (Weight * CP) |
| **Additional Information** | Link to study program<br>**www.ciw.kit.edu**<br><br>Department<br>**https://www.ciw.kit.edu/1627.php**<br><br>Business unit Studium und Lehre<br>**https://www.sle.kit.edu/vorstudium/bachelor-chemieingenieurwesen-verfahrenstechnik.php** |

## 1.2 Qualification Goals

The Bachelor's program provides knowledge on scientific fundamentals and methodical expertise in the area of Chemical and Process Engineering. The Bachelor degree qualifies students to enroll for a Master's program. Furthermore, it enables students to apply the acquired theoretical knowledge to a concrete professional field.

The compulsory program in the first and second year focuses on methodical and qualified fundamental knowledge of mathematics, natural sciences and engineering. This includes in particular the knowledge of heat and mass transfer and the most important unit operations in the field of thermal, chemical and mechanical process engineering. Graduates will be able to balance engineering processes appropriately.

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. As part of the specialization, students will apply basic process engineering knowledge in a project work. In addition to technical aspects, working on a project in a team as well as preparing, interpreting and presenting the results are important parts of the specialization subject.

Within their Bachelor's thesis, students prove the ability to work on specialized problems in the field of chemical and process engineering 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 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 Chemieingenieurwesen und Verfahrenstechnik***
*(Study and Examination Regulations of the Karlsruhe Institute of Technology (KIT) for the Bachelor Course of Studies in Chemical and Process Engineering)*
of 05 August 2015 amended on 24 February 2020.

## 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/english/1167.php**

## 2 Curriculum Bachelor Chemical and Process Engineering

## 2.1 Semester overview

| Semester CP | Fundamentals of Mathematics and Natural Sciences | Fundamentals of Scientific Engineering | Thermodynamics und Transport Processes | Fundamentals of Process Engineering | Lab Courses, Elective Courses, Thesis |
|---|---|---|---|---|---|
| 1 33 | Advanced Mathematics I (7) General and Inorganic Chemistry (6) | Engineering Mechanics: Statics (5) Mechanical Design (9) Material Science and Engineering (4) | | | Laboratory I Part I (2) |
| 2 31 | Advanced Mathematics II (7) Computational Methods (5) Organic Chemistry (5) | Engineering Mechanics: Strength of Material (5) Material Science and Engineering (5) | | | Basic Practical Course Part II (4) |
| 3 30 | Advanced Mathematics III (7) Computational Methods – Lab (3) | Engineering Mechanics: Dynamics (5) | Thermodynamics I (7) | | Advanced Practical Course (5) Soft Skill Qualification (3)* |
| 4 29 | | | Thermodynamics II (7) Heat and Mass Transfer (7) Fluiddynamics (5) Control Engineering and System Dynamics (5) | | Mandatory Elective Course I (5)* |
| 5 32 | Elementary Physics (7) | | | Chemical Process Engineering (6) Thermal Process Engineering (6) Mechanical Processing (6) | Mandatory Elective Course II (5)* Specialization/ Project Work (2)** |
| 6 25 | | | | | Specialization/ Project Work (10)** Soft Skill Qualification (3)* Bachelor Thesis (12) |

*Numbers in brackets: Credit points (CP)*

\* The distribution of the *Soft Skill Qualifications* and *Mandatory Elective Courses* over the semesters is a suggestion and can also be arranged differently depending on the modules selected.
In the area of *Soft Skill Qualifikations*, at least one of the modules *Industrial Business Administration* or *Ethics and Material Cycles* must be selected.

\*\* The *Specialization/ Project Work* lasts two semesters and always begins in the winter semester. A profile subject can be chosen from approx. 10 offers. The distribution of the workload between winter and summer semesters may differ for individual profile subjects.

## 2.2 Overview: Fields and Modules

| Area | Module | Responsible | SWS | CP |
|---|---|---|---|---|
| 47 CP Fundamentals of Mathematics and Natural Sciences | Advanced Mathematics I | Griesmeier | 6 | 7 |
| | Advanced Mathematics II | Griesmeier | 6 | 7 |
| | Advanced Mathematics III | Griesmeier | 6 | 7 |
| | Computational Methods | Stein | 3 + P | 8 |
| | General and Inorganic Chemistry | Ruben | 5 | 6 |
| | Organic Chemistry | Meier | 4 | 5 |
| | Elementary Physics | Pilawa | 6 | 7 |
| 38 CP Fundamentals of Scientific Engineering | Engineering Mechanics: Statics and Strength of Material | Willenbacher | 8 | 10 |
| | Engineering Mechanics: Dynamics | Klahn | 4 | 5 |
| | Material Science and Engineering | Schneider | 8 | 9 |
| | Mechanical Design A | Matthiesen/ Albers | 8 | 9 |
| | Control Engineering and System Dynamics | Meurer | 4 | 5 |
| 26 CP Thermodynamics and Transport Processes | Thermodynamics I | Enders | 5 | 7 |
| | Thermodynamics II | Enders | 5 | 7 |
| | Fluiddynamics | Nirschl | 4 | 5 |
| | Heat/ Mass Transfer | Wetzel | 5 | 7 |
| 18 CP Fundamentals of Process Engineering | Mechanical Processing | Dittler | 4 | 6 |
| | Thermal Process Engineering | Zeiner | 4 | 6 |
| | Chemical Process Engineering | Wehinger | 4 | 6 |
| 10 CP Mandatory Elective Courses | 2 Elective Modules | | 4 each | 5 each |
| 11 CP Laboratories | Basic Practical Course | Horn, Sinanis | P | 6 |
| | Either: Process Machines Or: Practical Course in Organic Chemistry for Chemical Engineers | Gleiß Rapp | P | 5 |
| 6 CP Soft Skill Qualifikations | 2 Elective Modules | | 2 each | 3 each |
| 12 CP Specialization/ Project Work | 1 Elective Module | | | 12 |
| 12 LP | Bachelorarbeit | | | 12 |
| SUMME | | | | 180 |

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

## 2.3 Lectures/ Exercises/ Laboratories
### (Semester Overview, Attendance Time hours per week)

| | 1. Semester (WS) | | | | | 2. Semester (SS) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | V | Ü | P | CP | E | V | Ü | P | CP | E |
| Advaned Mathematics I and II | 4 | 2 | - | 7 | S+K | 4 | 2 | - | 7 | S+K |
| Computational Methods | - | - | - | - | - | 2 | 1 | P | 5 | K |
| Engineering Mechanics: Statics/ Strength of Material | 2 | 2 | - | 5 | - | 2 | 2 | - | 5 | K |
| General and Inorganic Chemistry (AAC) | 3 | 2 | - | 6 | K | - | - | - | - | - |
| Material Science and Engineering I and II | 3 | 1 | - | 4 | - | 2 | 2 | - | 5 | M |
| Mechanical Design A | 4 | 2 | - | 9 | S+K | - | - | - | - | - |
| Organic Chemistry for Engineers | - | - | - | - | - | 2 | 2 | - | 5 | K |
| Basic Lab Course | - | - | P | 2 | S | - | - | P | 4 | S |
| *Total credit points/ Number of graded exams* | | | | *33* | *3* | | | | *31* | *5* |

| | 3. Semester (WS) | | | | | 4. Semester (SS) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | V | Ü | P | LP | E | V | Ü | P | LP | E |
| Advanced Mathematics III | 4 | 2 | - | 7 | S+K | - | - | - | - | - |
| Engineering Mechanics: Dynamics | 2 | 2 | - | 5 | S+K | - | - | - | - | - |
| Computational Methods | - | - | P | 3 | S | - | - | - | - | - |
| Control Engineering and System Dynamics | - | - | - | - | - | 2 | 2 | - | 5 | K |
| Fluiddynamics | - | - | - | - | - | 2 | 2 | - | 5 | S+K |
| Technical Thermodynamics I and II | 3 | 2 | - | 7 | S+K | 3 | 2 | - | 7 | S+K |
| Fundamentals of Heat- and Masstransfer | - | - | - | | | 3 | 2 | - | 7 | K |
| Mandatory Elective Courses | - | - | - | - | - | 2 | 2 | - | 5 | K |
| Lab (Chemistry or Process Engineering) 2 weeks Feb./March | - | - | P | 5 | S | - | - | - | - | - |
| Soft Skill Qualification | 2 | - | - | 3 | S | - | - | - | - | - |
| *Total credit points/ Number of graded exams* | | | | *30* | *3* | | | | *31* | *5* |

| | 5. Semester (WS) | | | | | 6. Semester (SS) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | V | Ü | P | LP | E | V | Ü | P | LP | E |
| Chemical Process Engineering | 2 | 2 | - | 6 | K | - | - | - | - | - |
| Thermal Process Engineering | 2 | 2 | - | 6 | K | - | - | - | - | - |
| Mechanical Processing | 2 | 2 | - | 6 | K | - | - | - | - | - |
| Elementary Physics | 4 | 2 | - | 7 | K | - | - | - | - | - |
| Mandatory Elective Courses | 4 | 2 | - | 5 | K | - | - | - | - | - |
| Specialization/ Project Work | 1 | 1 | - | 2 | - | 1 | 1 | P | 10 | A+M |
| Soft Skill Qualification* | | | | | - | 2 | - | - | 3 | S |
| Bachelor Thesis | - | - | - | | - | 360 hrs | | | 12 | A |
| *Total credit points/ Number of graded exams* | | | | *32* | *5* | | | | *25* | *3* |

WS: Wintersemester, SS: Sommersemester
V: Lecture;     Ü: Exercise     P: Practial/ Lab;     CP: Credit Points     E: Examination
K: Written exam,     M: Oral Exam,     A: Examination of another type/ thesis,  S: Completed Coursework (ungraded)

# 3 Study Program Structure

| Mandatory | |
|---|---|
| **Orientation Exam** <br> *This field will not influence the calculated grade of its parent.* | |
| **Bachelor's Thesis** | 12 CP |
| **Fundamentals of Mathematics and Natural Sciences** | 47 CP |
| **Fundamentals of Scientific Engineering** | 38 CP |
| **Thermodynamics and Transport Processes** | 26 CP |
| **Fundamentals of Process Engineering** | 18 CP |
| **Mandatory Elective Courses** | 10 CP |
| **Laboratories** <br> *First usage possible from Oct 01, 2023.* | 11 CP |
| **Specialization/ Project Work** | 12 CP |
| **Interdisciplinary Qualifications** | 6 CP |
| **Voluntary** | |
| **Master's Transfer Account** <br> *This field will not influence the calculated grade of its parent.* | |

## 3.1 Orientation Exam

**Election notes**

As an orientation exam, the following partial achievements must be passed by the end of the third semester:

- Advanced Mathematics I
- General and Inorganic Chemistry

| Mandatory | | | | |
|---|---|---|---|---|
| M-CIWVT-100874 | 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.
  - The following must be handed in1 copy at the dean's office/at the Bachelor Examination Board.
  - Handing in at the supervisor after consultation
- The date of submission is the date of submission to the Bachelor Examination Board.

| Mandatory | | | | |
|---|---|---|---|---|
| M-CIWVT-103204 | Module Bachelor's Thesis | DE | WS+SS | 12 CP |

## 3.3 Fundamentals of Mathematics and Natural Sciences

**Credits**
47

| Mandatory | | | | |
|---|---|---|---|---|
| M-MATH-100280 | Advanced Mathematics I | DE | Jährlich | 7 CP |
| M-MATH-100281 | Advanced Mathematics II | DE | SS | 7 CP |
| M-MATH-100282 | Advanced Mathematics III | DE | WS | 7 CP |
| M-CIWVT-101956 | Computational Methods | DE | Jährlich | 8 CP |
| M-CHEMBIO-101117 | General and Inorganic Chemistry | DE | WS | 6 CP |
| M-CHEMBIO-101115 | Organic Chemistry for Engineers | DE | SS | 5 CP |
| M-PHYS-100993 | Elementary Physics | DE | WS | 7 CP |

## 3.4 Fundamentals of Scientific Engineering

**Credits**
38

| Mandatory | | | | |
|---|---|---|---|---|
| M-CIWVT-101128 | Engineering Mechanics: Dynamics | DE | WS | 5 CP |
| M-MACH-102567 | Material Science and Engineering | DE | WS+SS | 9 CP |
| M-MACH-106527 | Mechanical Design A<br>*First usage possible from Oct 01, 2023.* | DE | WS | 9 CP |
| M-CIWVT-106308 | Control Engineering and System Dynamics<br>*First usage possible from Apr 01, 2023.* | DE | SS | 5 CP |
| M-CIWVT-104006 | Engineering Mechanics: Statics and Strength of Materials<br>*First usage possible from Oct 01, 2017.* | DE | Jährlich | 10 CP |

## 3.5 Thermodynamics and Transport Processes

**Credits**
**26**

| Mandatory | | | | |
|---|---|---|---|---|
| M-CIWVT-101129 | Thermodynamics I | DE | WS | 7 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 |

## 3.6 Fundamentals of Process Engineering

**Credits**
**18**

| Mandatory | | | | |
|---|---|---|---|---|
| M-CIWVT-101135 | Mechanical Processing | DE | WS | 6 CP |
| M-CIWVT-101134 | Thermal Process Engineering | DE | WS | 6 CP |
| M-CIWVT-101133 | Chemical Process Engineering | DE | WS | 6 CP |

## 3.7 Mandatory Elective Courses

**Credits**
**10**

**Election notes**

In most cases, two modules totaling 10 ECTS are chosen (regardless of whether the modules are offered in the summer or winter term). For most optional subjects, participation is not recommended before the fourth semester.

| Mandatory Elective Courses (Election: at least 10 credits) | | | | |
|---|---|---|---|---|
| M-CIWVT-103297 | Applied Apparatus Engineering | DE | SS | 5 CP |
| M-CIWVT-106475 | Biopharmaceutical Process Engineering<br>*First usage possible from Apr 01, 2025.* | DE | SS | 6 CP |
| M-CIWVT-106434 | Bioprocess Engineering<br>*First usage possible from Oct 01, 2024.* | DE | WS | 5 CP |
| M-CIWVT-106030 | Catalysts for the Energy Transition<br>*First usage possible from Oct 01, 2022.* | EN | SS | 5 CP |
| M-CIWVT-106433 | Introduction into Bioengineering<br>*First usage possible from Apr 01, 2024.* | DE | SS | 5 CP |
| M-ETIT-105690 | Electrochemical Energy Technologies<br>*First usage possible between Apr 01, 2021 and Mar 31, 2026.* | EN | WS | 5 CP |
| M-ETIT-105703 | Laboratory Course: Electrochemical Energy Technologies<br>*First usage possible from Oct 01, 2021.* | DE/EN | SS | 5 CP |
| M-CIWVT-101136 | Energy Process Engineering | DE | WS | 5 CP |
| M-CIWVT-106880 | Advanced Methods in Linear Control<br>*First usage possible from Oct 01, 2024.* | DE | WS | 6 CP |
| M-CIWVT-106444 | Intensification of Bioprocesses<br>*First usage possible from Apr 01, 2025.* | DE | SS | 6 CP |
| M-CIWVT-106476 | Food Bioprocess Engineering<br>*First usage possible from Oct 01, 2025.* | DE | WS | 6 CP |
| M-MACH-106528 | Mechanical Design B-C<br>*First usage possible from Oct 01, 2023.* | DE | WS | 12 CP |
| M-CIWVT-101137 | Industrial Organic Chemistry | DE | WS | 5 CP |
| M-CIWVT-107403 | Bioprocess Development<br>*First usage possible from Oct 01, 2025.* | DE | WS | 6 CP |

## 3.8 Laboratories

**Credits**
11

**Note regarding usage**
First usage possible from Oct 01, 2023.

| Mandatory | | | | |
|---|---|---|---|---|
| M-CIWVT-106500 | Basic Practical Course | DE | WS | 6 CP |
| **Advanced Practical Course (Election: 1 item)** | | | | |
| M-CIWVT-101139 | Process Machines | DE | WS | 5 CP |
| M-CHEMBIO-101116 | Practical Course in Organic Chemistry for Chemical Engineers | DE | WS | 5 CP |

| 3.9 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 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 on **22. June 2022** in which the individual subjects will be presented and the registration procedure explained.

The location and time of the information event will be published in good time on the faculty's and student council's homepages.

**The registration process is divided into two stages:**
**In July, the desired profile subjects can be selected via the following portal** https://portal.wiwi.kit.edu/
**After the allocation you can choose your specialization subject in the Study Portal, the choice is approved online by the faculty, afterwards the registration for the individual examinations is possible.**

**Election regulations**
Elections in this field require confirmation.

| Specialization/ Project Work (Election: at least 12 credits) | | | | |
| --- | --- | --- | --- | --- |
| M-CIWVT-104458 | **Applied Thermal Process Engineering** | DE | WS | 12 CP |
| M-CIWVT-106477 | **Automation and Control Systems Engineering**<br>*First usage possible from Oct 01, 2023.* | DE | WS | 12 CP |
| M-CIWVT-101143 | **Biotechnology** | DE | WS | 12 CP |
| M-CIWVT-106825 | **Chemical Reaction Engineering**<br>*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**<br>*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**<br>*First usage possible from Oct 01, 2022.* | DE | WS | 12 CP |
| M-CIWVT-101148 | **Food Technology** | DE | Jährlich | 12 CP |
| M-CIWVT-106448 | **Air Pollution Control**<br>*First usage possible from Oct 01, 2023.* | 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**<br>*First usage possible from Oct 01, 2025.* | DE | WS | 12 CP |

## 3.10 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 (FORUM), belong to interdisciplinary qualifications.

<u>Registration in the Campusmanagement System</u>

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**

**Election notes**
3 of the 6 LPs are fixed: At least one of the following modules must be selected:

- Ethics and Global Material Cycles
- Industrial Business Administration

Modules in the range of 3 LP can be freely selected. The following can be done

- either both of the above mentioned modules
- or any modules of at least 3 LP (e.g. HoC or FORUM courses)

can be selected.

| Soft Skill Qualifications (Election: at least 6 credits) | | | | |
|---|---|---|---|---|
| M-CIWVT-101149 | **Ethics and Global Material Cycles** | DE | SS | 3 CP |
| M-WIWI-100528 | **Industrial Business Administration** | | Jährlich | 3 CP |
| M-CIWVT-105848 | **SmartMentoring**<br>*First usage possible from Oct 01, 2021.* | DE | WS | 3 CP |
| M-CIWVT-106534 | **Data-Driven Modeling with Python**<br>*First usage possible from Oct 01, 2023.* | DE | WS | 3 CP |

## 3.11 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-101992 | Single Results | DE | 30 CP |

**Modelled Conditions**
The following conditions have to be fulfilled:

1. You need to have earned at least 120 credits in the following fields:
   - Fundamentals of Scientific Engineering
   - Fundamentals of Mathematics and Natural Sciences
   - Laboratories
   - Specialization/ Project Work
   - Thermodynamics and Transport Processes
   - Interdisciplinary Qualifications
   - Fundamentals of Process Engineering
   - Mandatory Elective Courses

# 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 (Usage from 10/1/2023)

| 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** <br> *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** <br> *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** <br> *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:**　Mandatory Elective Courses (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 (Usage from 10/1/2023)

| 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:**  Mandatory Elective Courses

| 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 successfull 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 [M-CIWVT-106500]

**Coordinators:**   Prof. Dr. Harald Horn
                    Dr. Sokratis Sinanis
**Organisation:**   KIT Department of Chemical and Process Engineering
**Part of:**        Laboratories (mandatory)

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 6 CP | pass/fail | Each winter term | 2 terms | German | 3 | 1 |

| Mandatory | | | |
|---|---|---|---|
| T-CIWVT-113117 | Laboratory Work: General Chemistry | 2 CP | Horn, West |
| T-CIWVT-113118 | Practical Course: Process Engineering | 4 CP | Sinanis |

## M  4.10 Module: Biopharmaceutical Process Engineering [M-CIWVT-106475]

**Coordinators:**   Prof. Dr. Jürgen Hubbuch
**Organisation:**   KIT Department of Chemical and Process Engineering
**Part of:**   Mandatory Elective Courses (Usage from 4/1/2025)

| 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    4.11 Module: Bioprocess Development [M-CIWVT-107403]

**Coordinators:**   Prof. Dr.-Ing. Alexander Grünberger
**Organisation:**   KIT Department of Chemical and Process Engineering
**Part of:**   Mandatory Elective Courses (Usage from 10/1/2025)

| 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  4.12 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:** | **Mandatory Elective Courses** (Usage from 10/1/2024) |

| 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 4.13 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 M-CIWVT-101138 - Lab Work Process Engineering must have been passed.
    2. The module **M-CIWVT-101139 - Process Machines** must have been passed.
    3. The module M-CIWVT-101722 - General Chemistry and Chemistry of Aqueous Solutions must have been passed.
    4. The module M-CIWVT-101964 - Laboratory Work in General and Inorganic Chemistry must have been passed.
    5. The module **M-CHEMBIO-101115 - Organic Chemistry for Engineers** must have been passed.
    6. The module component T-CIWVT-103331 - Laboratory Work: Biology for Engineers must have been passed.
    7. The module M-CIWVT-106427 - Basic Practical Course in Natural Sciences must have been passed.
    8. The module **M-CIWVT-106500 - Basic Practical Course** 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.

## 4.14 Module: Catalysts for the Energy Transition [M-CIWVT-106030]

**M**

**Coordinators:** TT-Prof. Dr. Moritz Wolf
**Organisation:** KIT Department of Chemical and Process Engineering
**Part of:** Mandatory Elective Courses (Usage from 10/1/2022)

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 5 CP | graded | Each summer term | 1 term | English | 4 | 1 |

| Mandatory | | | |
|---|---|---|---|
| T-CIWVT-112214 | Catalysts for the Energy Transition | 5 CP | Wolf |

**Assessment**
Learing control ist an oral exam, duration approx. 20 minutes.

**Prerequisites**
None.

**Competence Goal**
The students are able to explain properties and basic relationships in catalysis, know the preparation methods of heterogeneous catalysts and are familiar with characterisation techniques and their interpretation. They understand the interlink between the macroscopic and microscopic structural properties and activity, selectivity and stability based on exemplary sustainable applications of heterogeneous catalysis for the energy transition.

**Content**
Lecture:

- Introduction to catalysis: classification, significance and terminology
- Aspects of the (global) energy transition
    - Renewable energy sources
    - Hydrogen economy: production, purification, storage and transportation
- Components, preparation, characterisation and deactivation of heterogeneous catalysts for the following application examples
    - Production and conversion of synthesis gas
    - Valorisation of carbon dioxide: (point) sources, Power-to-X, sustainable chemicals
    - Chemical hydrogen storage
- Literature studies on catalyst design
    - Structure-reactivity and structure-stability relations
    - Alternative catalyst concepts

Practice:

- Processing and interpretation of data from catalyst characterisation
- Use cases from inand science

**Module Grade Calculation**
The module grade is the grade of oral examination.

**Workload**

- Attendance time: Lectures and exercises 45 h
- Self-study: 50 h
- Exam preparation: 55 h

**Literature**
Announced in lectures/on slides.

Fundamentals:

- I. Chorkendorff, J. W. Niemantsverdriet, *Concepts of Modern Catalysis and Kinetics*, 2003, Wiley.
- G. Ertl (Ed.), *Handbook of Heterogeneous Catalysis*, 2008, Wiley.

## M  4.15 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**

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 6 CP | graded | Each winter term | 1 term | German | 3 | 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  4.16 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  4.17 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 (Usage from 10/1/2022)

| 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  4.18 Module: Computational Methods [M-CIWVT-101956]

**Coordinators:**   Prof. Dr. Oliver Thomas Stein
**Organisation:**   KIT Department of Chemical and Process Engineering
**Part of:**   **Fundamentals of Mathematics and Natural Sciences**

| Credits | Grading | Duration | Language | Level | Version |
|---------|---------|----------|----------|-------|---------|
| 8 CP | graded | 2 terms | German | 3 | 1 |

| Mandatory | | | |
|---|---|---|---|
| T-MATH-102250 | **Introduction to Informatics and Algorithmic Mathematics - Exam** | 5 CP | Dörfler, Krause |
| T-CIWVT-101876 | **Application of Numerics in Engineering** | 3 CP | Stein |

### Assessment

The learning control consists of two partial achievements:

1. written examination lasting 75 minutes.
2. oral examination lasting approx. 10 minutes.
   Students must have understood knowledge about the content of the task and its solution and be able to reproduce it in their own words.

### Prerequisites

None

### Competence Goal

Higher programming languages, design and description of algorithms, basic algorithms from mathematics and computer science, implementation of mathematical concepts on computers, modeling and simulation of scientific and technical problems.

Students are able to solve engineering problems applying numerical methods, to solve a problem within a fixed time-frame in a team and to show their results in a concludin presentation.

### Content

The course offers the basics to advanced studies. Key concepts of the lectures are: structured program design, iteration, recursion, data structures (in particular: arrays), procedural programming with functions and methods, developing application-oriented programs. In computer labs, the mathematical concepts will be implemented.

Fundamentals to solve problems in process engineering by applying numerical methods.

### Module Grade Calculation

The module grade ist the grade of the written exam.

### Workload

Lecture:

- attendance time: 60 h
- self-study: 90 h

practical work, programming:

- attendance time: 10 h
- self-study: 80 h

## M 4.19 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** (Usage from 4/1/2023)

| 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  4.20 Module: Data-Driven Modeling with Python [M-CIWVT-106534]

**Coordinators:** Dr.-Ing. Frank Rhein
**Organisation:** KIT Department of Chemical and Process Engineering
**Part of:** Interdisciplinary Qualifications (Usage from 10/1/2023)

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

| Mandatory | | | |
|-----------|-----------------------------------|------|-------|
| T-CIWVT-113190 | Data-Driven Modeling with Python | 3 CP | Rhein |

## M  4.21 Module: Electrochemical Energy Technologies [M-ETIT-105690]

**Coordinators:**　Prof. Dr.-Ing. Ulrike Krewer
**Organisation:**　KIT Department of Electrical Engineering and Information Technology
**Part of:**　Mandatory Elective Courses (Usage between 4/1/2021 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 4.22 Module: Elementary Physics [M-PHYS-100993]

**Coordinators:** Prof. Dr. Alexey Ustinov
**Organisation:** KIT Department of Physics
**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-PHYS-101577 | **Elementary Physics** | 7 CP | Ustinov |

**Assessment**
See components of this module.

**Prerequisites**
The module *Advanced Mathematics I* has to be passed.

**Modeled Prerequisites**
The following conditions have to be fulfilled:

1. The module **M-MATH-100280 – Advanced Mathematics I** must have been passed.

**Recommendations**
Contents of *Engineering Mechanics: Dynamics*

**Literature**

- P. Tipler, Physik für Wissenschaftler und Ingenieure, Springer 2015
- E. Hering, R. Martin, M. Stohrer, Physik für Ingenieure, Springer 2016

## M    4.23 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 4.24 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:** **Mandatory Elective Courses**

| 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 4.25 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  4.26 Module: Engineering Mechanics: Statics and Strength of Materials [M-CIWVT-104006]

**Coordinators:**  Prof. Dr. Norbert Willenbacher
**Organisation:**  KIT Department of Chemical and Process Engineering
**Part of:**  Fundamentals of Scientific Engineering (Usage from 10/1/2017)

| Credits | Grading | Duration | Language | Level | Version |
|---------|---------|----------|----------|-------|---------|
| 10 CP | graded | 2 terms | German | 3 | 4 |

| Mandatory | | | |
|-----------|--|--|--|
| T-CIWVT-103687 | Engineering Mechanics: Statics and Strength of Materials | 10 CP | Hochstein, Oelschlaeger, Willenbacher |

### Assessment
Learning Control is a written examination lasting 90 minutes.

### Prerequisites
None

### Content
forces and momentums, static balance, bearings, frameworks, tension/ elongagion in general (3D), internal force variables of beams, friction, principle of virtual work, tension/ elongation in rods, hypothesis of stabiligy, torsion, buckling

### Module Grade Calculation
The module grade ist the grade of the written exam.

### Workload
Attendance time: 120 h
Self-study: 120 h
Exam preparation: 60 h

### Literature

- ross/Hauger/Schnell/Schröder: Technische Mechanik
  Bd. 1: Statik, Springer 2004, 8. Auflage;
  Bd. 2: Elastostatik Springer (2002) 7. Auflage,
- Hibbeler:
  Technische Mechanik 1- Statik, Pearson (2005), 10. Auflage;
  Technische Mechanik 2 - Festigkeitslehre, Pearson (2006) 5. Auflage
  Mechanics of Materials, Pearson (2004),
- Kühhorn/Silber: Technische Mechanik für Ingenieure, Hüthig (2000)
- Wriggers/Nackenhorst/Beuermann/Spiess/Löhnert: Technische Mechanik kompakt, Teubner (2006)
- Müller/Ferber: Technische Mechanik für Ingenieure (mit CD-Rom), Fachbuchverlag Leipzig (2005)
- Richard/Sander: Technische Mechanik - Festigkeitslehre, Vieweg (2006)

## M  4.27 Module: Ethics and Global Material Cycles [M-CIWVT-101149]

| | |
|---|---|
| **Coordinators:** | Prof. Dr. Reinhard Rauch |
| **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 | 4 |

| Mandatory | | | |
|---|---|---|---|
| T-CIWVT-112372 | Global Material Cycles | 1 CP | Rauch |
| T-CIWVT-112373 | Ethics | 2 CP | Hillerbrand |

### Assessment
Examination consists of

1. Ethics: regular attendance at lectures and exercises; short presentation; written elaboration
2. Global Material Cycles: written exmaination (ungraded), duration 60 minutes.

### Prerequisites
None

### Competence Goal
Basic understanding of: Examples of global material cycles and effects caused by human societies, Important limitations for material and energy conversion by human societies (civilization, industrialization), Basic knowledge in engineering ethics, Competences in "handling" with ethical questions for engineers

### Content
Bio-geosphere as environment for human life. selected examples of global material cycles. limits of man-made material and energy conversion. sustainability as term. priority rules for sustainability and for shaping the future. technology assessment, engineering codes. responsibility individual, collective, corporate

### Workload

- lectures and exercises: 15 h
- homework: 45 h
- preparation of examination:  30 h

### Literature

- I. v. d. Poel, L. Royakkers: Ethics, Technology and Engineering: An Introduction, Wiley-Blackwell 2011
- H. Lenk, M. Maring: Natur-Umwelt-Ethik, LIT Verlag Münster 2003
- G. Schaub, Th. Turek: Energy Flows, Material Cycles, and Global Development - A Process Engineering Approach to the Earth System, Springer Verlag Berlin 2010

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

**Coordinators:**   Prof. Dr.-Ing. Hermann Nirschl
**Organisation:**   KIT Department of Chemical and Process Engineering
**Part of:**   **Thermodynamics and Transport Processes**

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 5 CP | graded | Each summer term | 1 term | German | 3 | 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:**  Mandatory Elective Courses (Usage from 10/1/2025)

| 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 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  4.31 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  4.32 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:** **Thermodynamics and Transport Processes**

| 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**

**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  4.33 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  4.34 Module: General and Inorganic Chemistry [M-CHEMBIO-101117]

**Coordinators:** Prof. Dr. Mario Ruben
**Organisation:** KIT Department of Chemistry and Biosciences
**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-CHEMBIO-101866 | General and Inorganic Chemistry | 6 CP | Ruben |

**Assessment**
graded: written examination (150 min)

**Prerequisites**
none

**Competence Goal**
The students get a basic understanding of the inorganic chemistry. With the knowledge of the periodic table of the elements and basic knowledge of the chemical bond the students are able to describe different compounds and to estimate different reactivities.

**Content**
Structure of the matter, nuclear models, periodic table of the elements.The chemical bond. Structure of Metals, ion crystals, covalent bonds, metal complexes. Chemical reactions, chemical equilibrium, law of mass action, solubility product. Acids and bases, redox reactions

**Module Grade Calculation**
grade of the written examination

**Workload**
Lectures and exercises: 56h

Homework and preparation of examination: 94h

**Literature**
Mortimer, Müller (aktuelle Auflage): Chemie, Thieme Verlag

Riedel (aktuelle Auflage): Moderne Anorganische Chemie, de Gruyter Verlag

Hollemann, Wieberg (aktuelle Auflage): Lehrbuch der Anorganischen Chemie, de Gruyter Verlag

M. Binnewies, M. Jäckel, H. Willner, G. Rayner-Canham: Allgemeine und Anorganische Chemie, Spektrum Verlag 2004

C. E. Housecroft, A. G. Sharpe, Anorganische Chemie, Pearson Verlag 2006.

**Base For**
Anorganisch chemisches Praktikum

## M  4.35 Module: Industrial Business Administration [M-WIWI-100528]

| | |
|---|---|
| **Coordinators:** | Prof. Dr. Wolf Fichtner |
| **Organisation:** | KIT Department of Economics and Management |
| **Part of:** | **Interdisciplinary Qualifications** |

| Credits | Grading | Duration | Level | Version |
|---|---|---|---|---|
| 3 CP | pass/fail | 1 term | 3 | 1 |

| Mandatory | | | |
|---|---|---|---|
| T-WIWI-100796 | **Industrial Business Administration** | 3 CP | Fichtner |

### Assessment
The assessment of this course is a ungraded written examination (60 min) according to §4(2), 1 of the examination regulation.

### Prerequisites
None

### Competence Goal
Students are able to describe and differentiate legal forms for industrial enterprises.

Students will gain knowledge about different ways of financing to raise capital.

The students gain knowledge about the basics of financial accounting and are able to record and book performance and capital flows occurring in companies.

The students gain knowledge about different types of cost accounting and are able to apply them.

Students gain knowledge of the basics of investment planning and are able to evaluate investments economically.

The students gain knowledge about the basics of linear optimization and can solve simple optimization problems with the Simplex algorithm.

The students gain knowledge about basic marketing methods and can describe and differentiate them from each other.

The students gain knowledge about basic methods of project management and can apply them to practical examples.

### Content

- Goals and basics
- Legal framework for industrial enterprises
- financial accounting
- cost accounting
- investment calculation
- optimisation
- network technique

### Workload
The total workload for this course is approximately 90 hours.

## M 4.36 Module: Industrial Organic Chemistry [M-CIWVT-101137]

**Coordinators:** Prof. Dr. Reinhard Rauch
**Organisation:** KIT Department of Chemical and Process Engineering
**Part of:** Mandatory Elective Courses

| 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  4.37 Module: Intensification of Bioprocesses [M-CIWVT-106444]

**Coordinators:** Prof. Dr.-Ing. Dirk Holtmann
**Organisation:** KIT Department of Chemical and Process Engineering
**Part of:** Mandatory Elective Courses (Usage from 4/1/2025)

| 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 excercieses
- 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  4.38 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:** Mandatory Elective Courses (Usage from 4/1/2024)

| 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  4.39 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  4.40 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:** Mandatory Elective Courses (Usage from 10/1/2021)

| 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 | **4.41 Module: Material Science and Engineering [M-MACH-102567]** |
|---|---|

**Coordinators:** Dr.-Ing. Johannes Schneider
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** **Fundamentals of Scientific Engineering**

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

| Mandatory | | | |
|---|---|---|---|
| T-MACH-105148 | **Examination Material Science I & II** | 9 CP | Schneider |

**Assessment**
oral exam

**Prerequisites**
None

**Competence Goal**
The students are able to describe the relationship between atomic structure, microscopical observations, and properties of solid materials.

The students can describe the typical property profiles and can name applications for the most important engineering materials.

The students are able to describe standard materials characterization methods and can explain the evaluation of these methods. They can judge materials on base of the data obtained by these methods.

The students are able to describe the basic mechanisms of hardening for ferrous and non-ferrous materials and reflect these mechanisms using phase and TTT diagrams.

The students can interpret given phase, TTT or other diagrams relevant for materials science, gather information from them and can correlate them regarding the microstructure evolution.

The students can describe the phenomena correlated with materials science in polymers, metals and ceramics and depict differences.

The students know about standard materials characterization methods and are able to asses materials on base of the data obtained by these methods.

**Content**
Atomic structure and atomic bonds

Structures of crystalline and amorphous solids

Defects in crystalline solids

Alloys

Transport and transformation phenomena in the solid state
Corrosion

Wear

Mechanical properties
Testing of materials
Ferrous materials

Non-ferrous metals and alloys

Polymers

Engineering ceramics
Composites

**Module Grade Calculation**
grade of the oral exam

**Workload**
regular attendance: 90 hours
self-study: 180 hours

**Teaching and Learning Methods**
lectures and exercices

**Literature**
W. Bergmann: Werkstofftechnik I + II, Hanser Verlag, München, 2008/9
M. Merkel: Taschenbuch der Werkstoffe, Hanser Verlag, München, 2008
R. Schwab: Werkstoffkunde und Werkstoffprüfung für Dummies, Wiley VCH, Weinheim, 2011
J.F. Shackelford; Werkstofftechnologie für Ingenieure, Pearson Studium, München, 2008 (E-Book)
J.F. Shackelford,: Introduction to Materials Science for Engineers. Prentice Hall, 2008
lecture notes and lab script

## M    4.42 Module: Mechanical Design A [M-MACH-106527]

**Coordinators:**     Prof. Dr.-Ing. Tobias Düser
                      Prof. Dr.-Ing. Sven Matthiesen

**Organisation:**     KIT Department of Electrical Engineering and Information Technology
                      KIT Department of Mechanical Engineering

**Part of:**    **Fundamentals of Scientific Engineering** (Usage from 10/1/2023)

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

| Mandatory | | | |
|-----------|---------------------------|-------|-------------------|
| T-MACH-112984 | **Mechanical Design A** | 7 CP | Düser, Matthiesen |
| T-MACH-112981 | **Mechanical Design A, Workshop** | 2 CP | Düser, Matthiesen |

**Assessment**
See individual courses

**Prerequisites**
None

**Competence Goal**
In mechanical design, students acquire skills in analysis and synthesis using examples. These include both individual machine elements such as bearings or springs and more complicated systems such as gears or couplings. After completing the machine design theory, the students are able to apply the contents learned to other technical systems - even those not known from the lecture - by transferring the principles of action and basic functions learned from examples to other contexts. This enables students to independently analyze unknown technical systems and synthesize suitable systems for given problems.

**Content**
MD A

   • Springs
   • Technical Systems
   • Bearings
   • Sealings
   • Component Joints
   • Gears

**Module Grade Calculation**
The module grade ist the grade of the written exam.

**Additional Information**
None

**Workload**
MKL A: Total workload: 240 h, thereof attendance 75 h, divided into lecture + exercise: 4 SWS -> 60 h as well as workshop: 1 SWS -> 15 h; self-study 165 h

**Recommendations**
None

**Teaching and Learning Methods**
Lectures, exercises and semester-long workshops as well as project work

**Literature**
Grundlagen der Berechnung und Gestaltung von Maschinenelementen; Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X  oder Volltextzugriff über Uni-Katalog der Universitätsbibliothek

Grundlagen von Maschinenelementen für Antriebsaufgaben; Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

**Base For**
None

## M    4.43 Module: Mechanical Design B-C [M-MACH-106528]

**Coordinators:**    Prof. Dr.-Ing. Tobias Düser
Prof. Dr.-Ing. Sven Matthiesen

**Organisation:**    KIT Department of Electrical Engineering and Information Technology
KIT Department of Mechanical Engineering

**Part of:**    Mandatory Elective Courses (Usage from 10/1/2023)

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

| Mandatory | | | |
|-----------|------|------|----------------|
| T-MACH-112985 | **Mechanical Design B and C** | 6 CP | Düser, Matthiesen |
| T-MACH-112982 | **Mechanical Design B, Workshop** | 3 CP | Düser, Matthiesen |
| T-MACH-112983 | **Mechanical Design C, Workshop** | 3 CP | Düser, Matthiesen |

**Assessment**
See individual courses

**Prerequisites**
None

**Competence Goal**
In mechanical design, students acquire skills in analysis and synthesis using examples. These include both individual machine elements such as bearings or springs and more complicated systems such as gears or couplings. After completing the machine design theory, the students are able to apply the contents learned to other technical systems - even those not known from the lecture - by transferring the principles of action and basic functions learned from examples to other contexts. This enables students to independently analyze unknown technical systems and synthesize suitable systems for given problems.

**Content**
MD B

- Design
- Tolerances & Fittings
- Gear Transmission
- Clutches

MD C

- Bolt connections
- Dimensioning
- Electric Motors + Hydraulics

**Module Grade Calculation**
The module grade ist the grade of the written exam.

**Additional Information**
None

**Workload**
MKL B: Total workload: 180 h, thereof attendance: 67.5 h, divided into lecture + tutorial: 3 SWS -> 45 h and workshop: 1.5 SWS -> 22.5; self-study 112.5 h

MKL C: Total workload: 180 h, of which attendance: 67.5 h, divided into lecture + exercise: 3 SWS -> 45 h as well as workshop: 1.5 SWS -> 22.5; self-study 112.5 h

**Recommendations**
None

**Teaching and Learning Methods**
Lectures, exercises and semester-long workshops as well as project work

**Literature**
Grundlagen der Berechnung und Gestaltung von Maschinenelementen; Steinhilper, Sauer, Springer Verlag, ISBN 3-540-22033-X   oder Volltextzugriff über Uni-Katalog der Universitätsbibliothek

Grundlagen von Maschinenelementen für Antriebsaufgaben; Steinhilper, Sauer, Springer Verlag, ISBN 3-540-29629-8

**Base For**
None

## 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

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 6 CP | graded | Each winter term | 1 term | German | 3 | 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: 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 4.47 Module: Module Bachelor's Thesis [M-CIWVT-103204]

| | |
|---|---|
| **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 | 3 |

| Mandatory | | | |
|---|---|---|---|
| T-CIWVT-106365 | Bachelor's Thesis | 12 CP | |

**Prerequisites**

§ 14 (1) SPO

**Modeled Prerequisites**

The following conditions have to be fulfilled:

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

**Competence Goal**

Students are able to work on specialised problems with scientific methods independently and within a defined time frame.

| M | **4.48 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  4.49 Module: Orientation Exam [M-CIWVT-100874]

**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 | 1 |

| 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-CHEMBIO-101866 | General and Inorganic Chemistry | 6 CP | Ruben |

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

**Prerequisites**
None

## M  4.50 Module: Practical Course in Organic Chemistry for Chemical Engineers [M-CHEMBIO-101116]

**Coordinators:** Dr. Andreas Rapp
**Organisation:** KIT Department of Chemistry and Biosciences
**Part of:** Laboratories (Advanced Practical Course )

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 5 CP | pass/fail | Each winter term | 1 term | German | 3 | 1 |

| Mandatory | | |
|---|---|---|
| T-CHEMBIO-101868 | Practical Course in Organic Chemistry for Chemical Engineers | 5 CP | Rapp |

**Assessment**
protocols and analytical results

**Prerequisites**
Compulsory preconditions: written examination OC

**Competence Goal**
After that course the students should be able to build up a reaction apparatus, to handle hazardous materials and perform chemical reactions. Furthermore the students get an insight in most important purification procedures, e.g. distilation, extraction.

**Content**
Key reactions in Organic Chemistry, e.g.: nucleophilic substitution, electrophilic aromatic substitution, carbony compounds, additions to non-activated double bonds

**Module Grade Calculation**
average out of lab experiments/ analytical results

**Workload**
lectures and exercises: 45h

homework and preparation of examination:  75h

**Literature**
Schwetlick: Organikum, Wiley-VCH

## M  4.51 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 4.52 Module: Process Machines [M-CIWVT-101139]

**Coordinators:** Prof. Dr.-Ing. Hermann Nirschl
**Organisation:** KIT Department of Chemical and Process Engineering
**Part of:** Laboratories (Advanced Practical Course )

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 5 CP | pass/fail | Each winter term | 1 term | German | 3 | 1 |

| Mandatory | | | |
|-----------|---|---|---|
| T-CIWVT-101903 | **Laboratory Work Process Machines** | 5 CP | Gleiß |

**Assessment**
Learning control is a completed courswwork (not graded):
during lab course for each experiment
starting colloquium oral/written, practical work, written report

**Prerequisites**
written exam "organic chemistry" must be passed.

**Competence Goal**
The students are able to explain fundamentals of process design for selected process apparatuses and machines. They have the ability to carry out practical experiments to these processes by themselves after advice and according to a manual, to collect experimental data, to describe and to interpret them. They can make easy calculations regarding the design of the examined processes.

**Content**

- error calculation
- pumps
- electroseparator
- power input into stirred vessels
- heat transfer in and out stirred vessels
- refrigerator/heat pump
- emulsification
- tranport of plastic granulate in a scrw-reactor
- volume flow measurement of gases
- residence time measurement

**Module Grade Calculation**
Non graded

**Workload**
presence time: 7 experiments, 30 h
preparation and reports: 120 h

**Literature**
scripts for lecture and manuals for lab course

## M 4.53 Module: Single Results [M-CIWVT-101992]

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

| Credits | Grading | Language | Level | Version |
|---------|---------|----------|-------|---------|
| 30 CP | pass/fail | German | 3 | 7 |

| Master Transfer Examinations (Election: at least 30 credits) | | | |
|---|---|---|---|
| T-CIWVT-106149 | Initial Exam Process Technology and Plant Design | 0 CP | Scheiff |
| T-CIWVT-106148 | Practical Course Process Technology and Plant Design | 0 CP | Scheiff |
| T-CIWVT-106150 | Process Technology and Plant Design Written Exam | 8 CP | Scheiff |
| 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-106033 | Thermodynamics III | 6 CP | Enders |
| T-CIWVT-106036 | Internship | 14 CP | Bajohr |

**Prerequisites**
None

## M   4.54 Module: SmartMentoring [M-CIWVT-105848]

**Coordinators:**  Dr.-Ing. Barbara Freudig
**Organisation:**  KIT Department of Chemical and Process Engineering
**Part of:**  Interdisciplinary Qualifications (Usage from 10/1/2021)

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

| Mandatory | | | |
|---|---|---|---|
| T-CIWVT-111761 | SmartMentoring - Group Management | 2 CP | Freudig |

## M 4.55 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

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 6 CP | graded | Each winter term | 1 term | German | 3 | 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  4.56 Module: Thermodynamics I [M-CIWVT-101129]

**Coordinators:** Prof. Dr. Sabine Enders
**Organisation:** KIT Department of Chemical and Process Engineering
**Part of:** Thermodynamics and Transport Processes

| 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  4.57 Module: Thermodynamics II [M-CIWVT-101130]

**Coordinators:**  Prof. Dr. Sabine Enders
**Organisation:**  KIT Department of Chemical and Process Engineering
**Part of:**  **Thermodynamics and Transport Processes**

| Credits | Grading | Recurrence | Duration | Language | Level | Version |
|---------|---------|------------|----------|----------|-------|---------|
| 7 CP | graded | Each summer term | 1 term | German | 3 | 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-100874 – Orientation Exam |
| | M-MATH-100280 – Advanced Mathematics I |

| **Type** Written examination | **Credits** 7 CP | **Grading** graded | **Term offered** Each term | **Version** 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** Written examination | **Credits** 7 CP | **Grading** graded | **Term offered** Each term | **Version** 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<br>Examination of another type | Credits<br>5 CP | Grading<br>graded | Version<br>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, �khblended (On-Site/Online), ◖ On-Site, ✗ Cancelled

## Assessment

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

## Prerequisites

None

## T  5.7 Module component: Application of Numerics in Engineering [T-CIWVT-101876]

| | |
|---|---|
| **Coordinators:** | Prof. Dr. Oliver Thomas Stein |
| **Organisation:** | KIT Department of Chemical and Process Engineering |
| **Part of:** | M-CIWVT-101956 - Computational Methods |

| **Type** Coursework (oral) | **Credits** 3 CP | **Grading** pass/fail | **Version** 2 |
|---|---|---|---|

| Courses | | | | | |
|---|---|---|---|---|---|
| WT 25/26 | 2232150 | **Practical Course Numerics in Engineering Science** | 3 SWS | Practical course / 🎤 | Stein, und Mitarbeitende |

| Exams | | | |
|---|---|---|---|
| WT 25/26 | 7231108_Kolloquium | **Application of Numerics in Engineering** | Habisreuther, Stein |

Legend: 📱 Online, ❖ Blended (On-Site/Online), 🎤 On-Site, ✗ Cancelled

### Prerequisites

Written Examination T-MATH-102250 - Einstieg in die Informatik und algorithmische Mathematik

### Modeled Prerequisites

The following conditions have to be fulfilled:

1. The module component **T-MATH-102250 - Introduction to Informatics and Algorithmic Mathematics - Exam** must have been started.

## T  5.8 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  5.9 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<br>Examination of another type | Credits<br>6 CP | Grading<br>graded | Term offered<br>Each winter term | Version<br>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   5.10 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** Examination of another type | **Credits** 6 CP | **Grading** graded | **Term offered** Each summer term | **Version** 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  5.11 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  5.12 Module component: Bachelor's Thesis [T-CIWVT-106365]

**Organisation:**   KIT Department of Chemical and Process Engineering
**Part of:**   M-CIWVT-103204 – Module Bachelor's Thesis

| Type | Credits | Grading | Term offered | Version |
|------|---------|---------|--------------|---------|
| Final Thesis | 12 CP | graded | Each term | 3 |

**Final Thesis**

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

| | |
|---|---|
| **Submission deadline** | 4 months |
| **Maximum extension period** | 4 weeks |
| **Correction period** | 6 weeks |

This thesis requires confirmation by the examination office.

## T   5.13 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-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  5.14 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-101992 - 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  5.15 Module component: Bioprocess Development [T-CIWVT-114538]

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

**Part of:**  M-CIWVT-107403 - 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  5.16 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  5.17 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  5.18 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  5.19 Module component: Catalysts for the Energy Transition [T-CIWVT-112214]

**Coordinators:** TT-Prof. Dr. Moritz Wolf
**Organisation:** KIT Department of Chemical and Process Engineering
**Part of:** M-CIWVT-106030 - Catalysts for the Energy Transition

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

| Courses | | | | | |
|---------|---|---|---|---|---|
| ST 2025 | 2231410 | Catalysts for the Energy Transition | 2 SWS | Lecture / 🎤 | Wolf |
| ST 2025 | 2231411 | Übungen zu 2231410 Catalysts for the Energy Transition | 1 SWS | Practice / 🎤 | Wolf |
| **Exams** | | | | | |
| ST 2025 | 7200100 | Catalysts for the Energy Transition | | | Wolf |
| WT 25/26 | 7231410 | Catalysts for the Energy Transition | | | Wolf |

Legend: 📱 Online, ⚙ Blended (On-Site/Online), 🎤 On-Site, ✘ Cancelled

**Assessment**
Oral exam, duration approx. 20 minutes.

**Prerequisites**
None.

## T  5.20 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   5.21 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    5.22 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** | **5.23 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**<br>Oral examination | **Credits**<br>8 CP | **Grading**<br>graded | **Term offered**<br>Each winter term | **Version**<br>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  5.24 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   5.25 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-101992 - 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   5.26 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   5.27 Module component: Data-Driven Modeling with Python [T-CIWVT-113190]

**Coordinators:** Dr.-Ing. Frank Rhein
**Organisation:** KIT Department of Chemical and Process Engineering
**Part of:** M-CIWVT-106534 - Data-Driven Modeling with Python

| Type | Credits | Grading | Version |
|------|---------|---------|---------|
| Coursework | 3 CP | pass/fail | 1 |

| Courses | | | | | |
|---------|---|---|---|---|---|
| WT 25/26 | 2245320 | Data-Driven Modeling with Python | 2 SWS | Lecture / 🗣 | Rhein |
| **Exams** | | | | | |
| WT 25/26 | 7291320 | Data-Driven Modeling with Python - Project | | | Rhein |

Legend: 🗖 Online, ⧉ Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

| T | **5.28 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**

## T  5.29 Module component: Elementary Physics [T-PHYS-101577]

**Coordinators:** Prof. Dr. Alexey Ustinov
**Organisation:** KIT Department of Physics
**Part of:** M-PHYS-100993 – Elementary Physics

| Type | Credits | Grading | Version |
|---|---|---|---|
| Written examination | 7 CP | graded | 1 |

| Courses | | | | | |
|---|---|---|---|---|---|
| WT 25/26 | 4040321 | Physikalische Grundlagen für die Studiengänge Chemie- und Bioingenieurwesen sowie Verfahrenstechnik | 4 SWS | Lecture / 🖤 | Ustinov |
| WT 25/26 | 4040322 | Übungen zu Physikalische Grundlagen für die Studiengänge Chemie- und Bioingenieurwesen sowie Verfahrenstechnik | 2 SWS | Practice / 🖤 | Ustinov, Fischer |
| **Exams** | | | | | |
| ST 2025 | 7800108 | Elementary Physics | | | Wernsdorfer |
| WT 25/26 | 7800108 | Elementary Physics | | | Ustinov |

Legend: 📱 Online, ⚯ Blended (On-Site/Online), 🖤 On-Site, ✗ Cancelled

**Assessment**
Written exam (usually about 180 min)

## T   5.30 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**   5.31 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 Examination of another type | Credits 4 CP | Grading graded | Version 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  5.32 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** Written examination | **Credits** 5 CP | **Grading** graded | **Term offered** Each term | **Version** 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**  **5.33 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** Coursework | **Credits** 0 CP | **Grading** pass/fail | **Term offered** Each winter term | **Version** 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  5.34 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   5.35 Module component: Engineering Mechanics: Statics and Strength of Materials [T-CIWVT-103687]

**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-104006 - Engineering Mechanics: Statics and Strength of Materials

| Type | Credits | Grading | Term offered | Version |
|---|---|---|---|---|
| Written examination | 10 CP | graded | Each term | 2 |

| Courses | | | | | |
|---|---|---|---|---|---|
| ST 2025 | 2242220 | **Engineering Mechanics: Strength of Materials** | 2 SWS | Lecture / 🗣 | Oelschlaeger, Hochstein |
| ST 2025 | 2242221 | **Exercises on 2242220 Engineering Mechanics: Strength of Materials** | 2 SWS | Practice / 🗣 | Oelschlaeger, Hochstein, und Mitarbeitende |
| ST 2025 | 2242222 | **Seminar zur Technischen Mechanik – Festigkeitslehre** | 2 SWS | Seminar / 🗣 | Oelschlaeger, Hochstein, und Mitarbeitende |
| 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 | 7290002 | **Engineering Mechanics: Statics and Strength of Materials** | | | Oelschlaeger, Hochstein |
| WT 25/26 | 7290002 | **Engineering Mechanics: Statics and Strength of Materials** | | | Hochstein, Oelschlaeger |

Legend: 📱 Online, ⚭ Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Prerequisites**

## T   5.36 Module component: Ethics [T-CIWVT-112373]

| | |
|---|---|
| **Coordinators:** | Prof. Dr. Dr. Rafaela Hillerbrand |
| **Organisation:** | KIT Department of Chemical and Process Engineering |
| **Part of:** | M-CIWVT-101149 - Ethics and Global Material Cycles |

| **Type** Coursework | **Credits** 2 CP | **Grading** pass/fail | **Term offered** Each summer term | **Version** 1 |
|---|---|---|---|---|

| Courses | | | | | |
|---|---|---|---|---|---|
| ST 2025 | 2231160 | Ethics and Global Material Cycles | 2 SWS | Lecture / 🗣✳ | Hillerbrand, Rauch |
| **Exams** | | | | | |
| ST 2025 | 7230001 | Ethics | | | Hillerbrand |

Legend: 📱 Online, ⬡ Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

## Prerequisites
None.

## T  5.37 Module component: Examination Material Science I & II [T-MACH-105148]

**Coordinators:**   Dr.-Ing. Johannes Schneider
**Organisation:**   KIT Department of Mechanical Engineering

**Part of:**   M-MACH-102567 - Material Science and Engineering

| **Type** Oral examination | **Credits** 9 CP | **Grading** graded | **Term offered** Each winter term | **Version** 1 |
|---|---|---|---|---|

| **Courses** | | | | | |
|---|---|---|---|---|---|
| ST 2025 | 2182562 | Materials Science and Engineering II for ciw, vt, mit | 4 SWS | Lecture / Practice ( / 🎙) | Schneider |
| WT 25/26 | 2181555 | Materials Science and Engineering I for ciw, vt, MIT | 4 SWS | Lecture / Practice ( / 🎙) | Schneider |
| **Exams** | | | | | |
| ST 2025 | 76-T-MACH-105148 | Examination Material Science I & II | | | Schneider |
| WT 25/26 | 76-T-MACH-105148 | Examination Material Science I, II | | | Schneider |

Legend: 📱 Online, ⧉ Blended (On-Site/Online), 🎙 On-Site, ✗ Cancelled

**Assessment**
oral; 30 to 40 minutes

No tools and reference tools are allowed!

**Prerequisites**
none

**Additional Information**
The course is offered in German.

**Workload**
270 hours

## T 5.38 Module component: Excercises: Membrane Technologies [T-CIWVT-113235]

| | |
|---|---|
| **Coordinators:** | Prof. Dr. Harald Horn<br>Dr.-Ing. Florencia Saravia |
| **Organisation:** | KIT Department of Chemical and Process Engineering |
| **Part of:** | M-CIWVT-101992 - 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  5.39 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  5.40 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 5.41 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    5.42 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-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 5.43 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    5.44 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 5.45 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 | **5.46 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** Examination of another type | **Credits** 4 CP | **Grading** graded | **Term offered** Each summer term | **Version** 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  5.47 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  5.48 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   5.49 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 5.50 Module component: General and Inorganic Chemistry [T-CHEMBIO-101866]

| | |
|---|---|
| **Coordinators:** | Prof. Dr. Mario Ruben |
| **Organisation:** | KIT Department of Chemistry and Biosciences |
| **Part of:** | M-CHEMBIO-101117 - General and Inorganic Chemistry |
| | M-CIWVT-100874 - Orientation Exam |

| **Type**<br>Written examination | **Credits**<br>6 CP | **Grading**<br>graded | **Term offered**<br>Each winter term | **Version**<br>1 |
|---|---|---|---|---|

| Courses | | | | | |
|---|---|---|---|---|---|
| WT 25/26 | 5004 | **Allgemeine und Anorganische Chemie (für Studierende des Chemieingenieurwesens, der Angewandten Geowissenschaften sowie der Materialwissenschaften und Werkzeugtechnik)** | 3 SWS | Lecture / 🞄 | Behrens |
| WT 25/26 | 5005 | **Seminar zur Vorlesung Allgemeine und Anorganische Chemie (für Studierende des Chemieingenieurwesens, der Angewandten Geowissenschaften sowie der Materialwissenschaften und Werkzeugtechnik)** | 2 SWS | Seminar / 🞄 | Behrens, Schacherl |
| **Exams** | | | | | |
| WT 25/26 | 7100003 | **General and Inorganic Chemistry** | | | Anson, Behrens |
| WT 25/26 | 7100004 | **General and Inorganic Chemistry** | | | Anson, Behrens |

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

## T    5.51 Module component: Global Material Cycles [T-CIWVT-112372]

| | |
|---|---|
| **Coordinators:** | Prof. Dr. Reinhard Rauch |
| **Organisation:** | KIT Department of Chemical and Process Engineering |
| **Part of:** | M-CIWVT-101149 - Ethics and Global Material Cycles |

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

| Courses | | | | | |
|---|---|---|---|---|---|
| ST 2025 | 2231160 | Ethics and Global Material Cycles | 2 SWS | Lecture / 🗣 | Hillerbrand, Rauch |
| **Exams** | | | | | |
| ST 2025 | 7230000 | Global Material Cycles | | | Rauch |
| WT 25/26 | 7230000 | Ethics and Global Material Cycles | | | Rauch |

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

### Prerequisites
None.

## T  5.52 Module component: Industrial Business Administration [T-WIWI-100796]

**Coordinators:** Prof. Dr. Wolf Fichtner
**Organisation:** KIT Department of Economics and Management
**Part of:** M-WIWI-100528 - Industrial Business Administration

| Type | Credits | Grading | Term offered | Version |
|---|---|---|---|---|
| Coursework (written) | 3 CP | pass/fail | Each winter term | 1 |

| Courses | | | | | |
|---|---|---|---|---|---|
| WT 25/26 | 2581040 | Industrial Business Administration | 2 SWS | Lecture / 🗣 | Fichtner |
| **Exams** | | | | | |
| ST 2025 | 7981040 | Industrial Business Administration | | | Fichtner |
| WT 25/26 | 7981040 | Industrial Business Administration | | | Fichtner |

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

**Assessment**
The assessment of this course is a ungraded written examination (60 min).

**Prerequisites**
None

| **T** | **5.53 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**<br>Written examination | **Credits**<br>5 CP | **Grading**<br>graded | **Term offered**<br>Each term | **Version**<br>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  5.54 Module component: Initial Exam Process Technology and Plant Design [T-CIWVT-106149]

| | |
|---|---|
| **Coordinators:** | Dr. Frederik Scheiff |
| **Organisation:** | KIT Department of Chemical and Process Engineering |
| **Part of:** | M-CIWVT-101992 - Single Results |

| Type | Credits | Grading | Term offered | Version |
|---|---|---|---|---|
| Coursework (written) | 0 CP | pass/fail | Each winter term | 1 |

| Courses | | | | | |
|---|---|---|---|---|---|
| WT 25/26 | 2231010 | Process Technology and Plant Design I | 2 SWS | Lecture / 🗣 | Scheiff, Bajohr |
| WT 25/26 | 2231012 | Practical Course Process Technology and Plant Design | 1 SWS | Practical course / 🗣 | Scheiff, und Mitarbeitende |
| **Exams** | | | | | |
| WT 25/26 | 7230100 | Initial Exam Process Technology and Plant Design | | | Scheiff |
| WT 25/26 | 7230100-2 | Initial Exam Process Technology and Plant Design | | | Scheiff |

Legend: 📱 Online, ⚃ Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Assessment**
Completed coursework; ungraded exam

**Prerequisites**
None

## T   5.55 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-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  5.56 Module component: Internship [T-CIWVT-106036]

**Coordinators:**     Dr.-Ing. Siegfried Bajohr
**Organisation:**     KIT Department of Chemical and Process Engineering
**Part of:**     M-CIWVT-101992 - Single Results

| Type | Credits | Grading | Version |
|------|---------|---------|---------|
| Coursework | 14 CP | pass/fail | 1 |

| Exams | | | |
|---|---|---|---|
| WT 25/26 | 7200000 | **Internship** | Bajohr |

## T  5.57 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  5.58 Module component: Introduction to Informatics and Algorithmic Mathematics - Exam [T-MATH-102250]

**Coordinators:** Prof. Dr. Willy Dörfler
PD Dr. Mathias Krause

**Organisation:** KIT Department of Mathematics

**Part of:** M-CIWVT-101956 - Computational Methods

| Type | Credits | Grading | Version |
|------|---------|---------|---------|
| Written examination | 5 CP | graded | 1 |

| Courses | | | | | |
|---------|---|---|---|---|---|
| ST 2025 | 0150700 | **Einstieg in die Informatik und Algorithmische Mathematik (für Bio- und Chemie-Ingenieurwesen)** | 2 SWS | Lecture | Krause, Karch, Doll |
| ST 2025 | 0150800 | **Übungen zu 0150700** | 1 SWS | Practice | Krause, Karch, Doll |
| ST 2025 | 0150900 | **Praktikum zu 0150700** | 2 SWS | Practical course | Krause, Karch, Doll |
| WT 25/26 | 0101100 | **Einstieg in die Informatik und algorithmische Mathematik** | 2 SWS | Lecture / 🎤 | Krause |
| WT 25/26 | 0101200 | **Übungen zu 0101100** | 2 SWS | Practice / 🎤 | Krause |
| WT 25/26 | 0101300 | **Rechnerpraktikum zu 0101100** | 2 SWS | Practical course | Krause |
| **Exams** | | | | | |
| ST 2025 | 7700003_01 | **Introduction to Informatics and Algorithmic Mathematics - C++-Exam** | | | Krause |
| WT 25/26 | 7700003_02 | **Introduction to Informatics and Algorithmic Mathematics - Post-Exam (C++)** | | | Dörfler |

Legend: 📱 Online, 🔀 Blended (On-Site/Online), 🎤 On-Site, ✗ Cancelled

## T  5.59 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  5.60 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 5.61 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-101992 - 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  5.62 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    5.63 Module component: Laboratory Work Process Machines [T-CIWVT-101903]

**Coordinators:**    Dr.-Ing. Marco Gleiß
**Organisation:**    KIT Department of Chemical and Process Engineering
    **Part of:**    M-CIWVT-101139 - Process Machines

| **Type** Coursework (practical) | **Credits** 5 CP | **Grading** pass/fail | **Term offered** Each winter term | **Version** 4 |
|---|---|---|---|---|

| Courses | | | | | | |
|---|---|---|---|---|---|---|
| WT 25/26 | 2200300 | **Practical Course Process Machines** | 3 SWS | Practical course / 🗣 | Gleiß, Dietrich, Enders, Grohmann, Harth, Meyer, Nirschl, Stapf, van der Schaaf, Wetzel, Willenbacher, Zeiner, und Mitarbeitende |
| **Exams** | | | | | | |
| WT 25/26 | 7291999 | **Laboratory Work Process Machines** | | | Gleiß | |

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

### Prerequisites
Written Exam "Organic Chemistry" must be passed.

### Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module **M-CHEMBIO-101115 - Organic Chemistry for Engineers** must have been passed.
2. The module **M-CHEMBIO-101116 - Practical Course in Organic Chemistry for Chemical Engineers** must not have been started.

| T | **5.64 Module component: Laboratory Work: General Chemistry [T-CIWVT-113117]** |
|---|---|

**Coordinators:** Prof. Dr. Harald Horn
Stephanie West
**Organisation:** KIT Department of Chemical and Process Engineering
**Part of:** M-CIWVT-106500 - Basic Practical Course

| Type<br>Coursework (practical) | Credits<br>2 CP | Grading<br>pass/fail | Term offered<br>Each winter term | Version<br>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 | 2233060 | Basic Practical Course - Part I: General Chemistry | 2 SWS | Practical course / 🗣 | Horn, West |
| **Exams** | | | | | |
| WT 25/26 | 7233060 | Laboratory Work: General Chemistry | | | Horn |

Legend: 📱 Online, ⠿ Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Modeled Prerequisites**
The following conditions have to be fulfilled:

1. The module component T-CHEMBIO-101866 - General and Inorganic Chemistry must have been passed.

| **T** | **5.65 Module component: Mechanical Design A [T-MACH-112984]** |

| **Coordinators:** | Prof. Dr.-Ing. Tobias Düser |
| | Prof. Dr.-Ing. Sven Matthiesen |
| **Organisation:** | KIT Department of Mechanical Engineering |

**Part of:**   M-MACH-106527 - Mechanical Design A

| **Type** Written examination | **Credits** 7 CP | **Grading** graded | **Term offered** Each winter term | **Expansion** 1 semesters | **Version** 2 |
|---|---|---|---|---|---|

| Courses | | | | | |
|---|---|---|---|---|---|
| WT 25/26 | 2145170 | Mechanical Design A | 3 SWS | Lecture / 🔊 | Matthiesen, Düser |
| WT 25/26 | 2145194 | Tutorial for Mechanical Design A | 1 SWS | Practice / 🔊 | Matthiesen, Düser |
| **Exams** | | | | | |
| ST 2025 | 76T-MACH-112984 | Mechanical Design A | | | Matthiesen, Düser |
| WT 25/26 | 76-T-MACH-112984 | Mechanical Design A | | | Matthiesen, Düser |

Legend: 📱 Online, 🔀 Blended (On-Site/Online), 🔊 On-Site, ✘ Cancelled

**Assessment**
Written exam with a duration of 90 Minutes

**Prerequisites**
Admission to the exam only with succesful completion of Workshop Mechanical Design A (T-MACH-112981)

**Modeled Prerequisites**
The following conditions have to be fulfilled:

1.  The module component T-MACH-112981 - Mechanical Design A, Workshop must have been passed.

**Recommendations**
None

**Additional Information**
Students are familiar with the basic machine elements of technical systems and are able to analyze them in a system context

The course is offered in German.

**Workload**
210 hours

## T    5.66 Module component: Mechanical Design A, Workshop [T-MACH-112981]

| | |
|---|---|
| **Coordinators:** | Prof. Dr.-Ing. Tobias Düser <br> Prof. Dr.-Ing. Sven Matthiesen |
| **Organisation:** | KIT Department of Mechanical Engineering |

**Part of:**    M-MACH-106527 - Mechanical Design A

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

| Courses | | | | | |
|---|---|---|---|---|---|
| WT 25/26 | 2145171 | Mechanical Design A - Workshop | 1 SWS | Practical course / 🗣 | Matthiesen, Düser |

| Exams | | | |
|---|---|---|---|
| ST 2025 | 76-T-MACH-112981 | Mechanical Design A, Workshop | Düser, Matthiesen |
| WT 25/26 | 76-T-MACH-112981 | Mechanical Design A, Workshop | Düser, Matthiesen |

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

### Assessment

Concomitant to the lecture, a workshop with 3 workshop sessions takes place over the semester. During the workshop the students are divided into groups and their mechanical design knowledge will be tested during a colloquium at the beginning of every single workshop session. The attendance is mandatory and will be controlled.

The pass of the colloquia and the process of the workshop task are required for the successful participation.

### Prerequisites
None

### Recommendations
None

### Additional Information
The course is offered in German.

### Workload
60 hours

## T 5.67 Module component: Mechanical Design B and C [T-MACH-112985]

**Coordinators:** Prof. Dr.-Ing. Tobias Düser
Prof. Dr.-Ing. Sven Matthiesen

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-106528 - Mechanical Design B-C

| Type | Credits | Grading | Term offered | Expansion | Version |
|---|---|---|---|---|---|
| Written examination | 6 CP | graded | Each summer term | 2 semesters | 1 |

| Courses | | | | | |
|---|---|---|---|---|---|
| ST 2025 | 2146200 | **Mechanical Design B** | 2 SWS | Lecture / 🗣 | Matthiesen, Düser |
| ST 2025 | 2146201 | **Exercises for Mechanical Design B** | 1 SWS | Practice / 🗣 | Matthiesen, Düser |
| WT 25/26 | 2145140 | **Mechanical Design C** | 2 SWS | Lecture / 🗣 | Matthiesen, Düser |
| WT 25/26 | 2145141 | **Tutorials Mechanical Design C** | 1 SWS | Practice / 🗣 | Matthiesen, Düser |
| **Exams** | | | | | |
| ST 2025 | 76-T-MACH-112985 | **Mechanical Design B & C** | | | Matthiesen, Düser |
| WT 25/26 | 76-T-MACH-112985 | **Mechanical Design B & C** | | | Matthiesen, Düser |

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

**Assessment**
Written exam consisting of a written & design part (total 240 minutes)

**Prerequisites**
Admission to the exam only with succesful completion of Workshop Mechanical Design B (T-MACH-112982) AND Workshop Mechanical Design C (T-MACH-112983)

**Modeled Prerequisites**
The following conditions have to be fulfilled:

1. The module component **T-MACH-112983 - Mechanical Design C, Workshop** must have been passed.
2. The module component **T-MACH-112982 - Mechanical Design B, Workshop** must have been passed.

**Recommendations**
None

**Additional Information**
The course is offered in German.

**Workload**
180 hours

## T  5.68 Module component: Mechanical Design B, Workshop [T-MACH-112982]

| | |
|---|---|
| **Coordinators:** | Prof. Dr.-Ing. Tobias Düser |
| | Prof. Dr.-Ing. Sven Matthiesen |
| **Organisation:** | KIT Department of Mechanical Engineering |

**Part of:**   M-MACH-106528 - Mechanical Design B-C

| Type | Credits | Grading | Term offered | Expansion | Version |
|---|---|---|---|---|---|
| Coursework | 3 CP | pass/fail | Each summer term | 1 semesters | 1 |

| Courses | | | | | |
|---|---|---|---|---|---|
| ST 2025 | 2146202 | Workshop of Mechanical Design B | 2 SWS | Practical course / 🗣 | Matthiesen, Düser |
| **Exams** | | | | | |
| ST 2025 | 76-T-MACH-112982 | Mechanical Design B, Workshop | | | Matthiesen, Düser |

Legend: 🗎 Online, ⚄ Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Assessment**

Concomitant to the lecture, a workshop with 3 workshop sessions takes place over the semester. During the workshop the students are divided into groups and their mechanical design knowledge will be tested during a colloquium at the beginning of every single workshop session. The attendance is mandatory and will be controlled.

A CAD task from the area of mechanical design must be processed. This will be approved within an examination.

The pass of the colloquia and the process of the workshop task are required for the successful participation.

**Prerequisites**
None

**Recommendations**
None

**Additional Information**
The course is offered in German.

**Workload**
90 hours

| **T** | **5.69 Module component: Mechanical Design C, Workshop [T-MACH-112983]** |
|---|---|

**Coordinators:**   Prof. Dr.-Ing. Tobias Düser
Prof. Dr.-Ing. Sven Matthiesen

**Organisation:**   KIT Department of Mechanical Engineering

**Part of:**   M-MACH-106528 - Mechanical Design B-C

| **Type** Coursework | **Credits** 3 CP | **Grading** pass/fail | **Term offered** Each winter term | **Expansion** 1 semesters | **Version** 1 |
|---|---|---|---|---|---|

| Courses | | | | | |
|---|---|---|---|---|---|
| WT 25/26 | 2145142 | Workshop 'Mechanical Design C' | 1.5 SWS | Practical course / 🗣 | Matthiesen, Düser |
| **Exams** | | | | | |
| WT 25/26 | 76-T-MACH-112983 | Mechanical Design C, Workshop | | | Düser, Matthiesen |

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

**Assessment**

Concomitant to the lecture, a workshop with 3 workshop sessions takes place over the semester. During the workshop the students are divided into groups and their mechanical design knowledge will be tested during a colloquium at the beginning of every single workshop session. The attendance is mandatory and will be controlled.

A CAD task from the area of mechanical design must be processed. This will be approved within an examination.

The pass of the colloquia and the process of the workshop task are required for the successful participation.

**Prerequisites**
None

**Recommendations**
None

**Additional Information**
The course is offered in German.

**Workload**
90 hours

## T  5.70 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   5.71 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 | **5.72 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**

## T 5.73 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-101992 - 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  5.74 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 Chemieingenieurwesen und Verfahrenstechnik 2015. Es werden die praktische Mitarbeit, der schriftliche Bericht sowie die mündliche Präsentation der Ergebnisse individuell bewertet.

## Prerequisites

None

## T    5.75 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 Chemieingenieurwesen und Verfahrenstechnik 2015 im Umfang von ca. 25 Minuten zu Lehrveranstaltung "Auslegung von Mikroreaktoren".

**Prerequisites**

None

## T   5.76 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  5.77 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-101992 - 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  5.78 Module component: Practical Course in Organic Chemistry for Chemical Engineers [T-CHEMBIO-101868]

| | |
|---|---|
| **Coordinators:** | Dr. Andreas Rapp |
| **Organisation:** | KIT Department of Chemistry and Biosciences |
| **Part of:** | M-CHEMBIO-101116 - Practical Course in Organic Chemistry for Chemical Engineers |

| Type | Credits | Grading | Version |
|---|---|---|---|
| Coursework (practical) | 5 CP | pass/fail | 1 |

| Courses | | | | | |
|---|---|---|---|---|---|
| WT 25/26 | 5123 | Organisch-Chemisches Praktikum für Studierende des Chemie- und Bioingenieurwesens | | Practical course / 🎤 | Mitarbeiter, Rapp, Meier |
| **Exams** | | | | | |
| WT 25/26 | 7100018 | Practical Course in Organic Chemistry for Chemical Engineers | | | Rapp |

Legend: 📱 Online, 🔀 Blended (On-Site/Online), 🎤 On-Site, ✗ Cancelled

**Modeled Prerequisites**

The following conditions have to be fulfilled:

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

## T  5.79 Module component: Practical Course Process Technology and Plant Design [T-CIWVT-106148]

| | |
|---|---|
| **Coordinators:** | Dr. Frederik Scheiff |
| **Organisation:** | KIT Department of Chemical and Process Engineering |
| **Part of:** | M-CIWVT-101992 - Single Results |

| Type | Credits | Grading | Term offered | Version |
|---|---|---|---|---|
| Coursework (practical) | 0 CP | pass/fail | Each winter term | 1 |

| Courses | | | | | |
|---|---|---|---|---|---|
| WT 25/26 | 2231012 | **Practical Course Process Technology and Plant Design** | 1 SWS | Practical course / 🎤 | Scheiff, und Mitarbeitende |
| **Exams** | | | | | |
| WT 25/26 | 7230101 | **practical course Process Technology and Plant Design** | | | Scheiff |

Legend: 📱 Online, 🔀 Blended (On-Site/Online), 🎤 On-Site, ✗ Cancelled

### Assessment
Compleded coursework/ practical course

### Prerequisites
Ungraded exam

### Modeled Prerequisites
The following conditions have to be fulfilled:

1. The module component **T-CIWVT-106149 - Initial Exam Process Technology and Plant Design** must have been passed.

## T  5.80 Module component: Practical Course: Process Engineering [T-CIWVT-113118]

| | |
|---|---|
| **Coordinators:** | Dr. Sokratis Sinanis |
| **Organisation:** | KIT Department of Chemical and Process Engineering |
| **Part of:** | M-CIWVT-106500 - Basic Practical Course |

| Type | Credits | Grading | Term offered | Version |
|---|---|---|---|---|
| Coursework (practical) | 4 CP | pass/fail | Each summer term | 1 |

| Courses | | | | | |
|---|---|---|---|---|---|
| ST 2025 | 2200305 | Basic Practical Course - Part II: Process Engineering | 3 SWS | Practical course / 🎤 | Bajohr, Sinanis, Dietrich, Hochstein, Horn, Meyer, Müller, West, Wetzel, Zeiner, und Mitarbeitende |
| WT 25/26 | 2200350 | Safety Instruction and Introduction to Practical Courses 1st Semester BIW und CIW | 1 SWS | Lecture / 🎤 | Dietrich, Sinanis, West, und Mitarbeitende |
| **Exams** | | | | | |
| ST 2025 | 7200305 | Practical Course: Process Engineering | | | Sinanis |

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

**Modeled Prerequisites**
The following conditions have to be fulfilled:

1. The module component T-CHEMBIO-101866 - General and Inorganic Chemistry must have been passed.

## T  5.81 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   5.82 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 | **5.83 Module component: Process Technology and Plant Design Written Exam [T-CIWVT-106150]** |

**Coordinators:** Dr. Frederik Scheiff
**Organisation:** KIT Department of Chemical and Process Engineering
**Part of:** M-CIWVT-101992 - Single Results

| **Type** Written examination | **Credits** 8 CP | **Grading** graded | **Term offered** Each term | **Version** 1 |

| Courses | | | | | |
|---------|---------|-----------------------------------------------|--------|----------------------|--------------------------|
| ST 2025 | 2231011 | Process Technology and Plant Design II | 3 SWS | Lecture / 🗣 | Scheiff, Bajohr |
| WT 25/26 | 2231010 | Process Technology and Plant Design I | 2 SWS | Lecture / 🗣 | Scheiff, Bajohr |
| WT 25/26 | 2231012 | Practical Course Process Technology and Plant Design | 1 SWS | Practical course / 🗣 | Scheiff, und Mitarbeitende |
| **Exams** | | | | | |
| ST 2025 | 7230102 | Process Technology and Plant Design Written Exam | | | Scheiff |
| WT 25/26 | 7230102 | Process Technology and Plant Design Written Exam | | | Scheiff |

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

**Assessment**
Learning control is a written examination lasting 180 minutes.

**Prerequisites**
None

## T  5.84 Module component: SmartMentoring - Group Management [T-CIWVT-111761]

| | |
|---|---|
| **Coordinators:** | Dr.-Ing. Barbara Freudig |
| **Organisation:** | KIT Department of Chemical and Process Engineering |
| **Part of:** | M-CIWVT-105848 - SmartMentoring |

| **Type** | **Credits** | **Grading** | **Version** |
|---|---|---|---|
| Coursework | 2 CP | pass/fail | 1 |

| Exams | | | |
|---|---|---|---|
| WT 25/26 | 72000001 | SmartMentoring - Group Management | |

## T    5.85 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  5.86 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-101992 - 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 | 5.87 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** | **5.88 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  5.89 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  5.90 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   5.91 Module component: Thermodynamics III [T-CIWVT-106033]

| | |
|---|---|
| **Coordinators:** | Prof. Dr. Sabine Enders |
| **Organisation:** | KIT Department of Chemical and Process Engineering |
| **Part of:** | M-CIWVT-101992 - Single Results |

| Type | Credits | Grading | Version |
|---|---|---|---|
| Written examination | 6 CP | graded | 1 |

| Courses | | | | | |
|---|---|---|---|---|---|
| WT 25/26 | 2250030 | Thermodynamics III | 2 SWS | Lecture / 🗣 | Enders |
| WT 25/26 | 2250031 | Thermodynamics III - Exercises | 1 SWS | Practice / 🗣 | Enders, und Mitarbeitende |
| **Exams** | | | | | |
| ST 2025 | 7250030 | Thermodynamics III | | | Enders |
| WT 25/26 | 7250030 | Thermodynamics III | | | Enders |

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

**Assessment**

Learning control is a written examination lasting 90 minutes.

**Prerequisites**

None

## T  5.92 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-100874 - Orientation Exam |
| | M-MATH-100280 - Advanced Mathematics I |

| Type Coursework (written) | Credits 0 CP | Grading pass/fail | Term offered Each winter term | Version 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  5.93 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**<br>Coursework (written) | **Credits**<br>0 CP | **Grading**<br>pass/fail | **Term offered**<br>Each summer term | **Version**<br>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   5.94 Module component: Tutorial Advanced Mathematics III [T-MATH-100527]

| | |
|---|---|
| **Coordinators:** | PD Dr. Tilo Arens<br>Prof. Dr. Roland Griesmaier<br>PD Dr. Frank Hettlich |
| **Organisation:** | KIT Department of Mathematics |
| **Part of:** | M-MATH-100282 - Advanced Mathematics III |

| Type<br>Coursework (written) | Credits<br>0 CP | Grading<br>pass/fail | Term offered<br>Each winter term | Version<br>2 |
|---|---|---|---|---|

| **Courses** | | | | | |
|---|---|---|---|---|---|
| WT 25/26 | 0131500 | Übungen zu 0131400 | 2 SWS | Practice | Hettlich |
| **Exams** | | | | | |
| WT 25/26 | 6700006 | Tutorial Advanced Mathematics III | | | Arens, Griesmaier,<br>Hettlich |

**Assessment**

Learning assessment is carried out by written assigments (pre-requesite). Exact requirements will be communicated in the lectures.

**Prerequisites**

None.