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

SPO 2015
Winter term 2022/23
Date: 28/09/2022

KIT DEPARTMENT OF CHEMICAL AND PROCESS ENGINEERING
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1 General Information

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1.1 Qualification Profile

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.
1.2 Contact

Dean of students          Prof. Dr.-Ing. Achim Dittler
Study affairs/ study counseling       Dr.-Ing. Barbara Freudig
Master Examination Board         Prof. Dr.-Ing. Achim Dittler
Examination office                  Julia Hofer

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

1.3 Exam 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. All references to the SPO in this module manual refer to the above-mentioned SPO.

The statute of 05 August 2015 including the amending statute can be found in the appendix of this module manual (only in German).

1.4 Recognition of achievements according to § 19 SPO

A request for recognition of services which
- At another university
- Abroad
- Outside the higher education system

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

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

1.5 Additional achievements and interdisciplinary (soft skill) qualification

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

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

If the Soft Skill Qualification is taken at the HoC or Language Centre, then no certificate of approval is required for an examination achievement, as the achievements are automatically posted in the CAS system under "unallocated credits".
If you want to credit a performance that is listed under "unallocated credits", you have submit a form to the Masters Examination Board.

For forms, please refer to the website of the KIT Faculty of Chemical and Process Engineering [https://www.ciw.kit.edu/bpa.php](https://www.ciw.kit.edu/bpa.php)
# 2 Curriculum

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*Numbers in brackets = ECTS
## Overview: Fields and Modules

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CP: Credit Points (ECTS), SWS: weekly teaching hours
### Lectures/ Exercises/ Laboratories (Semester Overview, Attendance Time hours per week)

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<td>360 hours 12</td>
</tr>
<tr>
<td><strong>Total CP</strong></td>
<td><strong>32</strong></td>
<td><strong>25</strong></td>
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</tbody>
</table>

WS: Winter Term, SS: Summer Term V: Vorlesung (lecture); Ü: Übung (exercise); P: Praktikum (Lab); CP = Credit Points
### Overview graded and ungraded examinations

<table>
<thead>
<tr>
<th>1. FS</th>
<th>2. FS</th>
<th>3. FS</th>
<th>4. FS</th>
<th>5. FS</th>
<th>6. FS</th>
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<tbody>
<tr>
<td>S/V</td>
<td>S/V</td>
<td>S/V</td>
<td>K</td>
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<tr>
<td>HMI</td>
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<td>HM</td>
<td>RuS</td>
<td>Physik</td>
<td>ÜQ</td>
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<td>K</td>
<td>HM</td>
<td>HM</td>
<td>S/V</td>
<td>MVT</td>
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<td>S/V</td>
<td>K</td>
<td>VT</td>
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<td>K</td>
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<tr>
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<td>KOC</td>
<td>TM</td>
<td>S/V</td>
<td>Flui</td>
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<tr>
<td>Statik</td>
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<tr>
<td>S/V</td>
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<td>6 Ben.</td>
<td>6 Ben.</td>
<td>5 Ben.</td>
<td>5 Ben.</td>
<td>3 Ben.</td>
</tr>
</tbody>
</table>

Unbenotete Leistungen (Studienleistungen)
- S: Studienleistung, unbenotet
- S/V: Studienleistung: Vorleistung zu einer Prüfung, z. B. Übungsnachweise
- S/P: Praktikum unbenotet

Benotete Leistungen (Prüfungsleistungen)
- K: Klausur/Prüfungsleistung schriftlich
- M: Prüfungsleistung mündlich
- P: Praktikum/Prüfungsleistung anderer Art
- A: Abschlussarbeit

S: ungraded coursework
S/V: ungraded Coursework: Prerequisite for a written examination
S/P: Lab, ungraded
K: Written Examination
M: Oral Examination
P: Graded Lab
A: Thesis
### 3 Field of study structure

<table>
<thead>
<tr>
<th>Mandatory</th>
<th>Credits</th>
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<tbody>
<tr>
<td><strong>Orientation Exam</strong></td>
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<tr>
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<tr>
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<tr>
<td><strong>Fundamentals of Scientific Engineering</strong></td>
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<tr>
<td><strong>Thermodynamics and Transport Processes</strong></td>
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<tr>
<td><strong>Fundamentals of Process Engineering</strong></td>
<td>18 CR</td>
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<td><strong>Mandatory Elective Courses</strong></td>
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<tr>
<td><strong>Laboratories</strong></td>
<td>11 CR</td>
</tr>
<tr>
<td><strong>Specialization/ Project Work</strong></td>
<td>12 CR</td>
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<tr>
<td><strong>Interdisciplinary Qualifications</strong></td>
<td>6 CR</td>
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<td><strong>Additional Examinations</strong></td>
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<tr>
<td><strong>Master's Transfer Account</strong></td>
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#### 3.1 Orientation Exam

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<tr>
<td><strong>M-CIWVT-100874</strong> Orientation Exam</td>
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#### 3.2 Bachelor's Thesis

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#### 3.3 Fundamentals of Mathematics and Natural Sciences

<table>
<thead>
<tr>
<th>Mandatory</th>
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<tbody>
<tr>
<td><strong>M-MATH-100280</strong> Advanced Mathematics I</td>
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<tr>
<td><strong>M-MATH-100281</strong> Advanced Mathematics II</td>
<td>7 CR</td>
</tr>
<tr>
<td><strong>M-MATH-100282</strong> Advanced Mathematics III</td>
<td>7 CR</td>
</tr>
<tr>
<td><strong>M-CIWVT-101956</strong> Computational Methods</td>
<td>8 CR</td>
</tr>
<tr>
<td><strong>M-CHEMBIO-101117</strong> General and Inorganic Chemistry</td>
<td>6 CR</td>
</tr>
<tr>
<td><strong>M-CHEMBIO-101115</strong> Organic Chemistry for Engineers</td>
<td>5 CR</td>
</tr>
<tr>
<td><strong>M-PHYS-100993</strong> Elementary Physics</td>
<td>7 CR</td>
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</tbody>
</table>
## 3.4 Fundamentals of Scientific Engineering

<table>
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<tr>
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<tr>
<td>M-CIWVT-101128 Engineering Mechanics: Dynamics</td>
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<tr>
<td>M-MACH-102567 Material Science and Engineering</td>
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<tr>
<td>M-MACH-101299 Mechanical Design</td>
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<tr>
<td>M-MACH-101300 Control Engineering and System Dynamics</td>
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*First usage possible from 10/1/2017.*

## 3.5 Thermodynamics and Transport Processes

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>M-CIWVT-101129 Thermodynamics I</td>
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<tr>
<td>M-CIWVT-101130 Thermodynamics II</td>
<td>7 CR</td>
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<tr>
<td>M-CIWVT-101131 Fluidodynamics</td>
<td>5 CR</td>
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<tr>
<td>M-CIWVT-101132 Fundamentals of Heat and Mass Transfer</td>
<td>7 CR</td>
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## 3.6 Fundamentals of Process Engineering

<table>
<thead>
<tr>
<th>Mandatory</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-CIWVT-101135 Mechanical Processing</td>
<td>6 CR</td>
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<tr>
<td>M-CIWVT-101134 Thermal Process Engineering</td>
<td>6 CR</td>
</tr>
<tr>
<td>M-CIWVT-101133 Chemical Process Engineering</td>
<td>6 CR</td>
</tr>
</tbody>
</table>
3 FIELD OF STUDY STRUCTURE

3.7 Mandatory Elective Courses

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)

<table>
<thead>
<tr>
<th>Module Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>M-CIWVT-101126</td>
<td>Food Biotechnology</td>
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<tr>
<td>M-CIWVT-101136</td>
<td>Energy Process Engineering</td>
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</tr>
<tr>
<td>M-CIWVT-101137</td>
<td>Industrial Organic Chemistry</td>
<td>5 CR</td>
</tr>
<tr>
<td>M-CIWVT-101972</td>
<td>International Concepts of Water Technologies</td>
<td>5 CR</td>
</tr>
<tr>
<td>M-CIWVT-101624</td>
<td>Biology for Engineers I</td>
<td>5 CR</td>
</tr>
<tr>
<td>M-CIWVT-103297</td>
<td>Applied Apparatus Engineering</td>
<td>5 CR</td>
</tr>
<tr>
<td>M-MACH-102829</td>
<td>Mechanical Design III and IV</td>
<td>13 CR</td>
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<tr>
<td>M-CIWVT-105517</td>
<td>Industrial Microbiology</td>
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</tr>
<tr>
<td>M-CIWVT-105518</td>
<td>Enzyme Technology</td>
<td>5 CR</td>
</tr>
<tr>
<td>M-ETIT-105690</td>
<td>Electrochemical Energy Technologies</td>
<td>5 CR</td>
</tr>
<tr>
<td>M-CIWVT-105698</td>
<td>Downstream Processing</td>
<td>5 CR</td>
</tr>
<tr>
<td>M-ETIT-105703</td>
<td>Laboratory Course: Electrochemical Energy Technologies</td>
<td>5 CR</td>
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<tr>
<td>M-CIWVT-106030</td>
<td>Catalysts for the Energy Transition</td>
<td>5 CR</td>
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</table>

3.8 Laboratories

### Laboratories (Election: at least 2 items as well as at least 11 credits)

<table>
<thead>
<tr>
<th>Module Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>M-CIWVT-101138</td>
<td>Lab Work Process Engineering</td>
<td>6 CR</td>
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<tr>
<td>M-CIWVT-101964</td>
<td>Laboratory Work in General and Inorganic Chemistry</td>
<td>6 CR</td>
</tr>
<tr>
<td>M-CIWVT-101139</td>
<td>Process Machines</td>
<td>5 CR</td>
</tr>
<tr>
<td>M-CHEMBIO-101116</td>
<td>Practical Course in Organic Chemistry for Chemical Engineers</td>
<td>5 CR</td>
</tr>
</tbody>
</table>
3.9 Specialization/ Project Work

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.

<table>
<thead>
<tr>
<th>Specialization/ Project Work (Electio: at least 12 credits)</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-CIWVT-101144 Rheology and Product Design</td>
<td>12 CR</td>
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<tr>
<td>M-CIWVT-101145 Energy and Environmental Engineering</td>
<td>12 CR</td>
</tr>
<tr>
<td>M-CIWVT-101147 Mechanical Separation Technology</td>
<td>12 CR</td>
</tr>
<tr>
<td>M-CIWVT-101148 Food Technology</td>
<td>12 CR</td>
</tr>
<tr>
<td>M-CIWVT-101141 Particle Technology</td>
<td>12 CR</td>
</tr>
<tr>
<td>M-CIWVT-101143 Biotechnology</td>
<td>12 CR</td>
</tr>
<tr>
<td>M-CIWVT-101152 Water Quality and Process Engineering of Water and Waste Water Treatment</td>
<td>12 CR</td>
</tr>
<tr>
<td>M-CIWVT-101154 Micro Process Engineering</td>
<td>12 CR</td>
</tr>
<tr>
<td>M-CIWVT-101153 Process Development and Scale-up</td>
<td>12 CR</td>
</tr>
<tr>
<td>M-CIWVT-104457 Fundamentals of Refrigeration</td>
<td>12 CR</td>
</tr>
<tr>
<td>M-CIWVT-104458 Applied Thermal Process Engineering</td>
<td>12 CR</td>
</tr>
<tr>
<td>M-CIWVT-105995 Circular Economy</td>
<td>12 CR</td>
</tr>
<tr>
<td><em>First usage possible from 10/1/2022.</em>*</td>
<td></td>
</tr>
</tbody>
</table>
A total of 6 LPs must be completed in the area of "soft skill qualifications" during the Bachelor's program. Non-technical modules, such as modules from other subject areas, language courses or other courses offered by the House of Competence (HoC) or the Centre for Applied Cultural Studies and General Studies (ZaK), belong to interdisciplinary qualifications.

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
- Intercultural Sensitivity and Competence

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

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

Soft Skill Qualifications (Election: at least 6 credits)

<table>
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<th>Credits</th>
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<td>M-CIWVT-101149</td>
<td>Ethics and Global Material Cycles</td>
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<tr>
<td>M-WIWI-100528</td>
<td>Industrial Business Administration</td>
<td>3 CR</td>
</tr>
<tr>
<td>M-CIWVT-105847</td>
<td>Intercultural Sensitivity and Competence</td>
<td>3 CR</td>
</tr>
<tr>
<td>M-CIWVT-105848</td>
<td>SmartMentoring</td>
<td>4 CR</td>
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</table>

First usage possible from 10/1/2021.

3.11 Additional Examinations

Additional Examinations (Election: at most 30 credits)

<table>
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<tr>
<th>Code</th>
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<tbody>
<tr>
<td>M-CIWVT-102011</td>
<td>Further Examinations</td>
<td>30 CR</td>
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</table>
### 3.12 Master's Transfer Account

Students who have already earned at least 120 LP in their Bachelor's programme can earn credit points from a consecutive Master's programme 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 from 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.

<table>
<thead>
<tr>
<th>Master Transfer Account (Election: at most 30 credits)</th>
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<tbody>
<tr>
<td>M-CIWVT-101992</td>
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**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

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

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

<table>
<thead>
<tr>
<th>Credits</th>
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<th>Duration</th>
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### Mandatory

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<tr>
<td>T-MATH-100275</td>
<td>Advanced Mathematics I</td>
<td>7 CR</td>
<td>Arens, Griesmaier, Hettlich</td>
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<tr>
<td>T-MATH-100525</td>
<td>Tutorial Advanced Mathematics I</td>
<td>0 CR</td>
<td>Arens, Griesmaier, Hettlich</td>
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</table>

### Competence Certificate

Learning assessment is carried by a written examination of length 120 minutes and by homework assignments (pre-requisites). A "pass" result on the pre-requisites 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
Module: Advanced Mathematics II [M-MATH-100281]

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

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

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<th>Recurrence</th>
<th>Duration</th>
<th>Language</th>
<th>Level</th>
<th>Version</th>
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</thead>
<tbody>
<tr>
<td>T-MATH-100276 Advanced Mathematics II</td>
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</tr>
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<td>T-MATH-100526 Tutorial Advanced Mathematics II</td>
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</table>

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

**Prerequisites**  
none

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

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

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

**Workload**  
In class: 90 hours  
- lectures, tutorials and examinations

**Independent study: 120 hours**  
- independent review of course material  
- work on homework assignments  
- preparation for written exams

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

**Literature**  
will be announced in class.

**Base for**  
Advanced Mathematics III
### 4.3 Module: Advanced Mathematics III [M-MATH-100282]

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

<table>
<thead>
<tr>
<th>Credits</th>
<th>Grading scale Grade to a tenth</th>
<th>Recurrence Each winter term</th>
<th>Duration 1 term</th>
<th>Language German</th>
<th>Level 3</th>
<th>Version 2</th>
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<tr>
<td>T-MATH-100277</td>
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</table>
| T-MATH-100527 | Tutorial Advanced Mathematics III  
This item will not influence the grade calculation of this parent. | 0 CR | Arens, Griesmaier, Hettlich |

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

**Prerequisites**  
none

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

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

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

**Workload**  
**In class: 90 hours**
- lectures, tutorials and examinations

**Independent study: 120 hours**
- independent review of course material
- work on homework assignments
- preparation for written exams

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

**Literature**  
will be announced in class.
Module: Applied Apparatus Engineering [M-CIWVT-103297]

Responsible: Dr. Martin Neuberger
Organisation: KIT Department of Chemical and Process Engineering
Part of: Mandatory Elective Courses

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

Competence Certificate
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)

**Responsible:** Dr.-Ing. Benjamin Dietrich
Dr. Philip Scharfer

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

**Part of:** Specialization/ Project Work

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<tr>
<th>Credits</th>
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<th>Duration</th>
<th>Language</th>
<th>Level</th>
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<td>Grade to a tenth</td>
<td>Each winter term</td>
<td>2 terms</td>
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### Mandatory

<table>
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<th>Title</th>
<th>Credits</th>
<th>Lecturers</th>
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<tbody>
<tr>
<td>T-CIWVT-110803</td>
<td>Applied Thermal Process Engineering - Exercises</td>
<td>6 CR</td>
<td>Dietrich, Scharfer</td>
</tr>
</tbody>
</table>

**Prerequisites**

Participation requires

- minimum 60 ECTS
- minimum 1 lab course

**Modeled Conditions**

The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in the following fields:
   - Fundamentals of Scientific Engineering
   - Fundamentals of Mathematics and Natural Sciences
   - Laboratories
   - Thermodynamics and Transport Processes
   - Interdisciplinary Qualifications
   - Fundamentals of Process Engineering
   - Mandatory Elective Courses

**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.

**Workload**

Lectures and exercises: 100 h
Home work: 160 h
Laboratory work (incl. interpretation and report): 100 h
**Recommendation**

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

**Literature**

- VDI-Wärmeatlas, Springer 2013
- Own Manuscripts
Module: Biology for Engineers I [M-CIWVT-101624]

**Responsible:** Prof. Dr. Christoph Syldatk

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

**Part of:** Mandatory Elective Courses

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**Mandatory**

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<td>T-CIWVT-111062</td>
<td>Cell Biology</td>
<td>3 CR</td>
<td>Gottwald</td>
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<tr>
<td>T-CIWVT-111063</td>
<td>Genetics</td>
<td>2 CR</td>
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</table>

**Competence Certificate**
The module is successfully completed by

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

**Prerequisites**
None

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

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

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

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

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

**Workload**
Attendance time: Lecture of 4 SWS: 60 h
Self-study time: 30 h
Exam preparation: 60 h

**Recommendation**
None
**Literature**

Cell biology

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

Genetics

- Munk, Taschenlehrbuch Biologie, Genetik (Thieme)
- Knippers, Genetik (Thieme)
4.7 Module: Biotechnology [M-CIWVT-101143]

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

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<th>Credits</th>
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<th>Duration</th>
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<th>Level</th>
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<td>Grade to a tenth</td>
<td>Each winter term</td>
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**Mandatory**

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<td>T-CIWVT-103668</td>
<td>Biotechnology</td>
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<tr>
<td>9</td>
<td>T-CIWVT-103669</td>
<td>Biotechnology</td>
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</tbody>
</table>

**Competence Certificate**
The module comprises two graded success controls according to § 4 (2) No 2,3 SPO:
1. written examination
2. practical work/ protocol/ presentation

The module grade is calculated from both parts of the module, part 1: 25%, part 2: 75%

Each of the course has to be passed ("ausreichend"). A failed course can be repeated one time, according to the SPO § 9 (2) - (6).

**Prerequisites**
Participation requires

- minimum 60 ECTS
- minimum 1 lab course

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

1. You have to fulfill one of 6 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 course T-CIWVT-103331 - Laboratory Work: Biology for Engineers must have been passed.

2. You need to have earned at least 60 credits in the following fields:
   ◦ Fundamentals of Scientific Engineering
   ◦ Fundamentals of Mathematics and Natural Sciences
   ◦ Laboritories
   ◦ Thermodynamics and Transport Processes
   ◦ Interdisciplinary Qualifications
   ◦ Fundamentals of Process Engineering
   ◦ Mandatory Elective Courses
Competence Goal
Basic understanding of processes and synthesis of processes in biotechnologic production

Lecture „Instrumental Bioanalytics“
The students are able to assign important methods of instrumental biotechnology to corresponding analytical problems. By deepening their theoretical understanding of physical-chemical analytics and working techniques the students become qualified to analyze fields of application and constraints thereof. They can compare/evaluate potentials and limitations of different methods and select suitable methods for (future) experimental work on their own.

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.

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

Content
Lecture „Instrumental Bioanalytics“
The lecture introduces to important instrumental methods in biotechnology including both theory and possible fields of application. Methods covered in the lecture are chromatographic separation techniques, spectroscopic structure analysis (MS, NMR, IR, absorption and fluorescence) as well as special microscopic techniques (fluorescence, CLSM, EM and SNOM). Beyond that, scanning probe microscopy and single molecule spectroscopy will be introduced.

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

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

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

Module grade calculation
weighted mean based on LP

Workload
Instrumental Bioanalytics (3 ECTS):
• Lectures and Exercises: 28 h
• Homework: 30 h
• Exam Preparation: 32 h

Management of scientific projects (3 ECTS):
• Lectures and Exercises: 28 h
• Homework: 64 h

Lab Work: (3 ECTS):
• Lab: 80 h
• Homework: 10 h

Project (3 ECTS)
• Lab: 10 h
• Homework: 80 h

Literature
Will be announced.
4.8 Module: Catalysts for the Energy Transition [M-CIWVT-106030]

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

<table>
<thead>
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<th>Credits</th>
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<th>Language</th>
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Mandatory

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<tr>
<td>T-CIWVT-112214</td>
<td>5</td>
<td>Wolf</td>
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</table>

Competence Certificate
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
Lectures:
- Introduction to catalysis: classification, significance and terminology
- Components, preparation, characterisation and deactivation of heterogeneous catalysts for the following application examples
  - Hydrogen economy: production, purification, storage and transport
  - Production and conversion of synthesis gas
  - Valorisation of carbon dioxide: (point) sources, Power-to-X, sustainable chemicals
  - Ammonia synthesis
- Literature studies on catalyst design and process intensification
  - Structure-reactivity and structure-stability relations
  - Catalyst integration in reactors

Practical:
- Processing and interpretation of data from catalyst characterisation
- Use cases from industry and science

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

Workload
- Lectures and exercises: 45 h
- Homework: 50 h
- Exam preparation: 55 h
4.9 Module: Chemical Process Engineering [M-CIWVT-101133]

**Responsible:** Prof. Dr. Bettina Kraushaar-Czarnetzki

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

**Part of:** Fundamentals of Process Engineering

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**Mandatory**

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<tr>
<td>T-CIWVT-101884</td>
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**Competence Certificate**

Learning control is a written examination of 120 min duration according to §4 Abs. 2 Nr. 1 SPO.

**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**

lecture: 56 h
self-study: 56 h
preparation of examination. 68 h

**Recommendation**

Courses of 1st - 4th semester

**Literature**

B. Kraushaar-Czarnetzki: "Klausuren mit Lösungen" (Studentenwerk).
### 4.10 Module: Circular Economy [M-CIWVT-105995]

**Responsible:** Prof. Dr.-Ing. Dieter Stapf  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** Specialization/ Project Work (Usage from 10/1/2022)

<table>
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**Mandatory**

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<tr>
<td>T-CIWVT-112172</td>
<td>Circular Economy - Oral Exam</td>
<td>8 CR</td>
<td>Stapf</td>
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<tr>
<td>T-CIWVT-112173</td>
<td>Circular Economy - Project Work</td>
<td>4 CR</td>
<td>Stapf</td>
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</tbody>
</table>

**Competence Certificate**  
The learning control consists of two partial achievements:

1. Oral exam on lectures, exercises and case studies, duration approx. 30 minutes.
2. Project work, examination 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

**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 h

**Self-study:**

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

**Exam preparation:** 90 h
### 4.11 Module: Computational Methods [M-CIWVT-101956]

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

#### Credits
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<th>Level</th>
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</table>

#### 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 concluding 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.

#### Mandatory

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<tr>
<th>Code</th>
<th>Course Title</th>
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<tr>
<td>T-MATH-102250</td>
<td>Introduction to Informatics and Algorithmic Mathematics - Exam</td>
<td>5 CR</td>
<td>Dörfler, Krause</td>
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<tr>
<td>T-CIWVT-101876</td>
<td>Application of Numerics in Engineering</td>
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</tbody>
</table>
Module: Control Engineering and System Dynamics [M-MACH-101300]

**Responsible:** Prof. Dr.-Ing. Christoph Stiller

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Fundamentals of Scientific Engineering

<table>
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**Mandatory**

| T-MACH-102126 | Control Engineering and System Dynamics | 5 CR | Stiller |

**Competence Certificate**

Type of Examination: written exam

Duration of Examination: 120 minutes

**Prerequisites**

Compulsory preconditions: none

Recommendation: courses of 1st - 3rd semester

**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**

grade of the written examination

**Workload**

150 hours

**Learning type**

2138332 Regelungstechnik und System-dynamik, 2V, 2 LP, compulsory course

2138333 Übungen zu Regelungstechnik und Systemdynamik, 1Ü, 2 LP, compulsory course

**Literature**

Stiller: Grundlagen der Mess- und Regelungstechnik, Shaker Verlag
4.13 Module: Downstream Processing [M-CIWVT-105698]

**Responsible:** Prof. Dr.-Ing. Jürgen Hubbuch

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

**Part of:** Mandatory Elective Courses (Usage from 4/1/2021)

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</table>

**Mandatory**

| T-CIWVT-101897 | Downstream Processing | 5 CR | Hubbuch |

**Competence Certificate**
Learning control is a written examination of 120 min duration.

**Prerequisites**
None.

**Competence Goal**
The students are able to analyse, structure and formally describe problems in the field of downstream processing. The students are able to critically evaluate the different processes.

**Content**
The lecture series addresses fundamentals in biotechnological purification of bio-products and respective analytics.

**Module grade calculation**
Grade of the written examination.

**Workload**
- Lectures and exercises: 60 h
- Homework: 50 h
- Preparation of examination: 40 h

**Recommendation**
Courses of 1st - 3rd semester

**Literature**
will be announced

**Base for**
Special Subject Biotechnology
Module: Electrochemical Energy Technologies [M-ETIT-105690]

**Responsible:** Prof. Dr.-Ing. Ulrike Krewer

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

**Part of:** Mandatory Elective Courses (Usage from 4/1/2021)

**Credits:** 5

**Grading scale:** Grade to a tenth

**Recurrence:** Each winter term

**Duration:** 1 term

**Language:** English

**Level:** 4

**Version:** 1

### Mandatory

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<td>T-ETIT-111352</td>
<td>Electrochemical Energy Technologies</td>
<td>5 CR</td>
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</tbody>
</table>

**Competence Certificate**

Type of Examination: Written exam
Duration of Examination: approx. 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 electrolyzers 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 electrolyzers
- Thermodynamics, potential and voltage of electrochemical cells
- Kinetics and electrochemical reactions
- Transport processes in electrochemical cells
- Composition and types of fuel cells and electrolyzers
- 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: \(30 \times 45 \text{ Min.} = 22.5 \text{ h}\)
2. Attendance in exercises: \(15 \times 45 \text{ Min.} = 11.25 \text{ h}\)
3. Preparation/follow-up Vorlesungen und Übungen: \(76.25 \text{ h} \text{ (approx. 1.75 h per lecture/exercise)}\)
4. Preparation of and attendance in examination: \(40 \text{ h}\)

In total: \(150 \text{ h} = 5 \text{ LP}\)
4.15 Module: Elementary Physics [M-PHYS-100993]

**Responsible:** Prof. Dr. Ralph Engel

**Organisation:** KIT Department of Physics

**Part of:** Fundamentals of Mathematics and Natural Sciences

<table>
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**Competence Certificate**

See components of this module

**Prerequisites**

The modules Advanced Mathematics I and Advanced Mathematics II have to be passed.

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The module M-MATH-100280 - Advanced Mathematics I must have been passed.
2. The module M-MATH-100281 - Advanced Mathematics II must have been passed.

**Recommendation**

Contents of *Engineering Mechanics: Dynamics*
Module: Energy and Environmental Engineering [M-CIWVT-101145]

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

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

**Part of:** Specialization/ Project Work

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<tr>
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<td>Energy and Environmental Engineering Project Work</td>
<td>4</td>
<td>Rauch, Trimis</td>
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<tr>
<td>T-CIWVT-108254</td>
<td>Energy and Environmental Engineering</td>
<td>8</td>
<td>Rauch, Trimis</td>
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</table>

**Competence Certificate**

The module comprises two graded success controls according to § 4 (2) No. 1, 3 SPO:
- written examination, duration 120 minutes
- project work

The module grade is calculated from the LP-weighted mean of both parts of the module.

Each of the course has to be passed "ausreichend". A failed course can be repeated one time, according to the SPO § 9 (2) - (6) of SPO.

**Prerequisites**

Participation requires

- minimum 60 ECTS
- minimum 1 lab course

**Modeled Conditions**

The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in the following fields:
   - Fundamentals of Scientific Engineering
   - Fundamentals of Mathematics and Natural Sciences
   - Laboratories
   - Thermodynamics and Transport Processes
   - Interdisciplinary Qualifications
   - Fundamentals of Process Engineering
   - Mandatory Elective Courses

**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.

**Workload**

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

**Recommendation**

Courses of 1st - 4th semester
Literature
lecture notes and specific literature indicated during lectures, additionally:
M. Crocker (Hrsg.): Thermochemical Conversion of Biomass to Liquid Fuels and Chemicals, Springer-Verlag, Berlin 2010

**Responsibility:** Prof. Dr.-Ing. Thomas Kolb  
Prof. Dr.-Ing. Nikolaos Zarzalis

**Organisation:** KIT Department of Chemical and Process Engineering  
Part of: Mandatory Elective Courses

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**Mandatory**

| T-CIWVT-101889 | Energy Process Engineering | 5 CR | Kolb |

**Competence Certificate**

Learning control is a written examination of 150 min duration according to § 4 Abs. 2 SPO.

**Prerequisites**

None.

**Competence Goal**

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

**Content**

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

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

Ecology / Economy / Policy

**Module grade calculation**

Grade of the written examination

**Workload**

lectures: 56 h  
self-study: 50 h  
preparation of examination: 44 h

**Recommendation**

Thermodynamik

**Literature**

In the lecture stated literatur, additionally:

- 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

**Responsible:** Prof. Dr.-Ing. Roland Dittmeyer
TT-Prof. Dr. Christoph Klahn

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

**Part of:** Fundamentals of Scientific Engineering

<table>
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**Mandatory**

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<td>T-CIWVT-106290</td>
<td>Engineering Mechanics: Dynamics</td>
<td>0 CR</td>
<td>Dittmeyer, Klahn</td>
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**Competence Certificate**
Assessment of success takes place via
1. a written examination of 90 minutes according to § 4, passage 2 of the Studies and Examinations Regulations (SPO)
2. prerequisite

**Prerequisites**
None

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

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

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

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

**Recommendation**
modules of 1. - 2. semester.

**Literature**
Kühlhorn/Silber: Technische Mechanik für Ingenieure, Hüthig 2000
Hibbler: Dynamik, Pearson 2006, 10. Auflage
Wriggers/Nackenhorst/Beuermann/Spiess/Löhncrt: Technische Mechanik kompakt, Teubner 2006

**Responsibility:** Prof. Dr. Norbert Willenbacher

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

**Part of:** Fundamentals of Scientific Engineering (Usage from 10/1/2017)

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<td>Engineering Mechanics: Statics</td>
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</table>

**Competence Certificate**

Learning Control consists of:

- A written examination "Statics" according § 4 (2) No 1 SPO. Duration: 90 minutes.
- A written examination "Strength of Material" according § 4 (2) No 1 SPO. Duration: 90 minutes.

**Prerequisites**

None

**Content**

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

**Module grade calculation**

Weighted average by credits.

**Workload**

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

**Literature**

- Gross/Hauger/Schnell/Schröder: Technische Mechanik
  - Bd. 2: Elastostatik Springer (2002) 7. Auflage,
  - Hibbeler: Technische Mechanik 1- Statik, Pearson 2005, 10. Auflage;
  - Technische Mechanik 2 - Festigkeitslehre,
  - Pearson (2006) 5. Auflage,
  - Kühhorn/Silber: Technische Mechanik für Ingenieure, Hüthig 2000
  - Wriggers/Nackenhorst/Beuermann/Spieß/Löhner: Technische Mechanik kompakt, Teubner 2006
  - Müller/Ferber: Technische Mechanik für Ingenieure (mit CD-Rom), Fachbuchverlag Leipzig 2005;
Module: Enzyme Technology [M-CIWVT-105518]

Responsible: Dr. Jens Rudat
Prof. Dr. Christoph Syldatk

Organisation: KIT Department of Chemical and Process Engineering
Part of: Mandatory Elective Courses (Usage from 10/1/2020)

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

Mandatory
T-CIWVT-111064 Biochemistry 3 CR Rudat
T-CIWVT-111074 Enzyme Technology 3 CR Syldatk

Competence Certificate
Learning Control consists of:

- written examination biochemistry according to § 4 Abs. 2 Nr. 1 SPO.
- written examination enzyme technology according to § 4 Abs. 2 Nr. 1 SPO.

Prerequisites
None.

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

Workload

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

Literature

- Voet/Voet/Pratt: "Lehrbuch der Biochemie" (Wiley-VCH)
- Koolman/Röhm Taschenatlas der Biochemie (Thieme)
### 4.21 Module: Ethics and Global Material Cycles [M-CIWVT-101149]

**Responsible:** Prof. Dr. Reinhard Rauch  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** Interdisciplinary Qualifications

<table>
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<th>Credits</th>
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#### Mandatory

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<td>T-CIWVT-112372</td>
<td>Global Material Cycles</td>
<td>1 CR</td>
<td>Rauch</td>
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<tr>
<td>T-CIWVT-112373</td>
<td>Ethics</td>
<td>2 CR</td>
<td>Hillerbrand</td>
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</table>

#### Competence Certificate

Examination consists of:
1. Ethics: regular attendance at lectures and exercises; short presentation; written elaboration
2. Global Material Cycles: written examination (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

4.22 Module: Fluidodynamics [M-CIWVT-101131]

**Responsible:**  Prof. Dr.-Ing. Hermann Nirschl

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

**Part of:**  Thermodynamics and Transport Processes

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<td>0 CR</td>
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**Competence Certificate**

Learning control consists of:
1. written exam of 120 minutes duration according to § 4 (2) SPO.
2. Non-graded precondition for participation according to § 4 (3) SPO: either 4 of 5 compulsory exercises have to be approved or a group presentation has to be given during the lecture

**Prerequisites**

none

**Competence Goal**

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

**Content**

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

**Module grade calculation**

grade of the written examination

**Workload**

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

**Recommendation**

Courses of 1st - 3rd semester

**Literature**

Nirschl, Zarzalis: Skriptum Fluidmechanik
Zierep: Grundzüge der Strömungslehre, Teubner 2008
Prandtl: Führer durch die Strömungslehre, Teubner 2008
4.23 Module: Food Biotechnology [M-CIWVT-101126]

**Responsible:** Prof. Dr.-Ing. Heike Karbstein

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

**Part of:** Mandatory Elective Courses

<table>
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<td>1 term</td>
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**Competence Certificate**
The Module comprises two success controls:
1. written examination
2. non-granted precondition for the admission to the examination: Illias-Test

**Prerequisites**
None

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

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

**Module grade calculation**
grade of the written examination.

**Workload**
Attendance time: 60 h
Preparation of presentation: 10 h
Exam Preparation: 20 h
homework: 60 h

**Recommendation**
Courses of 1st and 2nd semester.
Voluntary completion of homework sheets in ILIAS is recommended as exam preparation.

**Literature**
- Lebensmittelmikrobiologie (J. Krämer, UTB Ulmer)
- Lebensmittelbiotechnologie (Heinz Rutloff, Akademie Verlag)
- Lebensmittelverfahrenstechnik, Teil A (Schuchmann, Wiley)
- Lebensmittelbiotechnologie: eine Einführung (P. Czermak, GIT)
- Lebensmittelbiotechnologische (R. Heiss, Springer)
- Lexikon der Lebensmitteltechnologie (B. Kunz, Springer)
- Taschenatlas der Biotechnologie und Gentechnik (Rolf D. Schmid, Wiley)
- Mikroorganismen in Lebensmitteln (H. Keweloh, Pfanneberg)
- Mikrobiologie der Lebensmittel (G. Müller, H. Weber, Behr's)
- Grundzüge der Lebensmitteltechnik (H.-D. Tscheuschner, Behr's)
- Vorlesungsfolien, Skripte mit Übungsfragen, Vorlesungsvideos (ILIAS), FAQ zum Vorlesungsstoff und bereit gestellten Materialien (MS Teams)
Base for
special subject food technology
4.24 Module: Food Technology [M-CIWVT-101148]

**Responsible:** Prof. Dr.-Ing. Heike Karbstein

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

**Part of:** Specialization/ Project Work

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**Credits** 12  
**Grading scale** Grade to a tenth  
**Duration** 2 terms  
**Language** German  
**Level** 4  
**Version** 3

**Mandatory**

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**Competence Certificate**
The Module comprises two graded success controls according to § 4 (2) No 2, 3 SPO:

1. Written examination, duration 45 minutes
2. Project work (presentation and report of results)

The module grade is calculated from the LP-weighted mean of both parts of the module.

Each of the course has to be passed ("ausreichend"). A failed course can be repeated one time, according to the SPO § 9 (2) - (6) of SPO.

**Prerequisites**
Participation requires

- minimum 60 ECTS
- minimum 1 lab course

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

1. You need to have earned at least 60 credits in the following fields:
   - Fundamentals of Scientific Engineering
   - Fundamentals of Mathematics and Natural Sciences
   - Laboritories
   - Thermodynamics and Transport Processes
   - Interdisciplinary Qualifications
   - Fundamentals of Process Engineering
   - Mandatory Elective Courses

**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**
Weighted mean based on LP

**Workload**
Attendance time: 115 h
(lecture 1 SWS, exercises 1 SWS, project work 5 SWS)
self study: 185 h
exam preparation: 60 h
**Literature**
Will be offered within the lecture, depending on products available

**Responsible:** Prof. Dr.-Ing. Wilhelm Schabel
Prof. Dr.-Ing. Thomas Wetzel

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

**Part of:** Thermodynamics and Transport Processes

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

**Mandatory**


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

**Prerequisites**
none

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

**Content**


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

**Workload**
lecture: 75 h
self-study: 55 h
preparation of examination: 80 h

**Recommendation**
Courses of 1st – 3rd semester, especially fundamentals of thermodynamics.

**Literature**
Schabel: Stoffübertragung I, Skript
# 4.26 Module: Fundamentals of Refrigeration [M-CIWVT-104457]

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

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<thead>
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## Mandatory

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<tr>
<td>T-CIWVT-109117</td>
<td>Fundamentals of Refrigeration, oral examination</td>
<td>6 CR</td>
<td>Grohmann</td>
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<td>T-CIWVT-109118</td>
<td>Fundamentals of Refrigeration, Project Work</td>
<td>6 CR</td>
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## Competence Certificate

The Module comprises two graded succes controls according to § 4 (2) No 2,3:

1. Project work/ presentation
2. Oral exam of about 30 minutes duration

The project work is a prerequisite for the oral examination.

The module grade is calculated from the LP-weighted mean of both parts of the module. Each of the course has to be passed ("ausreichend"). A failed course can be repeated one time, according to the SPO § 9 (2) - (6).

## Prerequisites

Participation requires

- minimum 60 ECTS
- minimum 1 lab course

## Modeled Conditions

The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in the following fields:
   - Fundamentals of Scientific Engineering
   - Fundamentals of Mathematics and Natural Sciences
   - Laboratories
   - Thermodynamics and Transport Processes
   - Interdisciplinary Qualifications
   - Fundamentals of Process Engineering
   - Mandatory Elective Courses

## 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

Weighted mean based on LP
Workload
Attendance time: Lecture 2 SWS, Exercises 1 SWS: 45 h
Self-Study: 60 h
Exam Preparation: 75 h
Project work including presentation: 180 h

Recommendation
None

Literature
v. Cube, H.L. (Hrsg.), Lehrbuch der Kältetechnik Band 1 und 2, 4. Auflage (1997), C.F. Müller, Heidelberg
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)
4.27 Module: Further Examinations [M-CIWVT-102011]

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

**Part of:** Additional Examinations

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**Additional Examinations (Elect: at most 30 credits)**

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<tr>
<td>T-CIWVT-103790</td>
<td>Wildcard Additional Examinations 11</td>
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**Prerequisites**
None
Module: General and Inorganic Chemistry [M-CHEMBIO-101117]

**Responsible:** Prof. Dr. Mario Ruben

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

**Part of:** Fundamentals of Mathematics and Natural Sciences

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**Mandatory**

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<th>Module</th>
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**Competence Certificate**

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


**Base for**

Anorganisch chemisches Praktikum
4.29 Module: Industrial Business Administration [M-WIWI-100528]

**Responsible:** Prof. Dr. Wolf Fichtner

**Organisation:** KIT Department of Economics and Management

**Part of:** Interdisciplinary Qualifications

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**Mandatory**

| T-WIWI-100796 | Industrial Business Administration | 3 CR | Fichtner |

**Competence Certificate**

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.
Module: Industrial Microbiology [M-CIWVT-105517]

**Responsible:** apl. Prof. Dr. Matthias Franzreb  
Prof. Dr. Harald Horn  
Prof. Dr.-Ing. Jürgen Hubbuch  
Prof. Dr. Christoph Syldatk

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

**Part of:** Mandatory Elective Courses (Usage from 10/1/2020)

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<td>T-CIWVT-110128</td>
<td>Bioprocess Engineering</td>
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<td>Franzreb, Horn, Hubbuch</td>
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**Competence Certificate**

Learning Control consists of:

- Written examination Microbiology with a duration of 90 minutes (section 4, subsection 2 No. 1 SPO).
- Written examination Bioprocess Engineering with a duration of 90 minutes (section 4, subsection 2 No. 1 SPO).

**Prerequisites**

None

**Module grade calculation**

The grade of module ist the grade of written examination.

**Workload**

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

**Literature**

- Munk "Taschenlehrbuch Mikrobiologie" (Thieme)
- Cypionka "Grundlagen der Mikrobiologie" (Springer)
- Ratledge & Kristiansen: Basic Biotechnology (Cambridge University Press)
- Posten: Integrated Bioprocesses, De Gruyter, Berlin;
- Vorlesungsunterlagen
Module: Industrial Organic Chemistry [M-CIWVT-101137]

**Responsible:** Prof. Dr.-Ing. Jürgen Hubbuch

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

**Part of:** Mandatory Elective Courses

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**Mandatory**

| T-CIWVT-101890 | Industrial Organic Chemistry | 5 CR | Hubbuch, Rauch, Wörner |

**Competence Certificate**

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

**Prerequisites**

Organic Chemistry

**Competence Goal**

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

**Content**

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

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

**Module grade calculation**

grade of the written examination

**Workload**

lecture: 60 h

self-study: 40 h

preparation of examination: 50 h

**Literature**

Handouts

Onken, Behr: Chem. Prozeßkunde, Wiley-VCH 1996
Brahm: Polymerchemie kompakt, Hirzel 2009
Tieke: Makromolekulare Chemie, Wiley-VCH 2014
Hesse u.a.: Spektroskop. Methoden in der OC, Thieme 2011
### 4.32 Module: Intercultural Sensitivity and Competence [M-CIWVT-105847]

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Module: International Concepts of Water Technologies [M-CIWVT-101972]

**Responsible:** Prof. Dr. Andrea Schäfer

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

**Part of:** Mandatory Elective Courses

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**Mandatory**

| T-CIWVT-103704 | International Concepts of Water Technologies | 5 CR | Schäfer |

**Competence Certificate**

Assessment is an assignment of 25 pages and an oral presentation of 15 minutes.

**Prerequisites**

English language proficiency

**Competence Goal**

The students can explain concepts of water technologies (e.g. desalination, water reuse, decentralised systems, water & sanitation in international development) in their international context. The fundamentals of relevant water technologies will be understood and mass balances of water, contaminants and energy calculated. Based on these calculations decisions will be made how available water will be treated. After an overview on relevant renewable energies water technologies that are powered with renewable energies will be considered. An important ability in the international context are an understanding of the varying circumstances that are essential for decision making and successful system integration. Contributing factors of cost, operating strategies, cultural awareness, local environment and infrastructure availability are some of those factors to be considered.

**Content**

Global water issues, international water quality guidelines, concepts of water technologies, desalination, water reuse, water energy nexus, decentralised systems, emergency water supplies, water & sanitation in international development, renewable energies, operating concepts.

**Module grade calculation**

The result is a composite of the Case study report (assignment) and presentation.

**Annotation**

The course is held in English and the assignment/presentation are to be prepared in English. Presence is mandatory!

**Recommendation**

None.

**Literature**

Web of Science & Reference list for basic principles (provided in lectures) predominantly in English language.
4.34 Module: Lab Work Process Engineering [M-CIWVT-101138]

**Mandatory**

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**Responsible:** Dr. Sokratis Sinanis  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** Laboratories

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<td>T-CIWVT-108291</td>
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<td>T-CIWVT-108292</td>
<td>Laboratory Work Process Engineering</td>
<td>6 CR</td>
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**Competence Certificate**

Learning control consists of two ungraded course works according to § 4 section. 3 SPO:

1. safety instruction  
2. practical course (experiments and written final test).

Successful completion of the safety instruction is a prerequisite for participation in the experiments.

- The practical course is passed if all experiments as well as the final exam are passed.  
- An experiment is passed if both colloquium and protocol are passed.  
- A failed protocol may be revised once. If an experiment is not passed, it may be repeated during the same semester.  
  In total, a maximum of three experiments may be repeated once each.  
- The final test may be repeated once.  
- If the practical part is not passed or the final test is not passed in the second attempt, the entire course must be repeated.  
- Unexcused absence leads to repetition of the entire internship.

**Prerequisites**

Written exam "General and Inorganic Chemistry" must be passed.

**Competence Goal**

Carrying out successful experiments. Measurement of physical properties. Evaluation of data and writing a report.

**Content**

Lecture and seminar on process engineering practical course

- Introduction to good scientific practice  
- Error calculation and error estimation for measurements of physical quantities  
- Overview of the content and objectives of the experiments to be performed in the practical course

Practical part: Basic experiments from all areas of process engineering (each group performs 10 of the following experiments):

- Viscosimetry  
- Sieve analysis  
- Particle separation from air  
- Liquid-liquid extraction  
- Fractional distillation  
- Molar mass determination  
- Material data of gasoline and diesel  
- Energy balance of a furnace  
- Volume flow measurement of gases  
- Freezing of food: Ice crystallization from sugar-containing solutions  
- Soft drink  
- Iron kinetics  
- Determination of Avogadro constants  
- Vapor pressure curve of water  
- Determination of residence times
Module grade calculation
non-graded

Workload
Lab course/ Presence time: 60 h
(10 Experiments)
self study (preparation an reports): 120 h

Literature
Documents from each institute for the experiments. All required documentation for the course will be provided in ILIAS.
**Module: Laboratory Course: Electrochemical Energy Technologies [M-ETIT-105703]**

**Responsible:** Prof. Dr.-Ing. Ulrike Krewer

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

**Part of:** Mandatory Elective Courses (Usage from 10/1/2021)

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**Mandatory**

| T-ETIT-111376 | Laboratory Course: Electrochemical Energy Technologies | 5 CR | Röse |

**Competence Certificate**

The examination consists of a different kind of graded assessment including four experiments. The overall impression is rated. To pass the module, all experiments must be successfully completed. In case of failure, the laboratory course has to be repeated completely.

Attendance at the safety briefing and participation in an entry colloquium is mandatory (ungraded).

**Prerequisites**

The prerequisite for admission to the module is that students have successfully passed the module "M-ETIT-105690 – Electrochemical Energy Technologies".

**Modeled Conditions**

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 substate 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.

**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
4.36 Module: Laboratory Work in General and Inorganic Chemistry [M-CIWVT-101964]

Responsible: Prof. Dr. Harald Horn
Organisation: KIT Department of Chemical and Process Engineering
Part of: Laboratories

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**Mandatory**
- T-CHEMBIO-101867 Laboratory Work in General and Inorganic Chemistry Part I
- T-CIWVT-108293 Safety Instruction
- T-CIWVT-108294 Laboratory Work in General and Inorganic Chemistry Part II

**Prerequisites**
Written exam "General and Inorganic Chemistry" must be passed.

**Competence Goal**
The students receive a basic knowledge of the general chemistry. They can handle chemicals and can perform qualitative and quantitative analysis in aqueous solutions. They can perform calculations, and can apply the necessary tools to understand the context.

**Content**
Lab experiments of qualitative analysis and reactions

**Workload**
presence time: 120 h
self-study: 60 h

**Literature**
Mortimer, Müller Chemie, Thieme Verlag 2019
Riedel, Meyer, Allgemeine und Anorganische Chemie, 11. Auflage, de Gruyter Verlag 2013
Horn, Abbt-Braun: Praktikumsskript, aktuelle Ausgabe, siehe ILIAS Studierendenportal oder Papierversion;
Ruben, Dsoke: Unterlagen im ILIAS Studierendenportal oder Papierversion
Module: Material Science and Engineering [M-MACH-102567]

**Responsible:** Dr.-Ing. Johannes Schneider  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** Fundamentals of Scientific Engineering

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### Mandatory

| T-MACH-105148 | Examination Material Science I & II | 9 CR | Schneider |

**Competence Certificate**  
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

Learning type
lectures and exercices

Literature
W. Bergmann: Werkstofftechnik I + II, Hanser Verlag, München, 2008/9
M. Merkel: Taschenbuch der Werkstoffe, Hanser Verlag, München, 2008
J.F. Shackelford; Werkstofftechnologie für Ingenieure, Pearson Studium, München, 2008 (E-Book)
lecture notes and lab script
### 4.38 Module: Mechanical Design [M-MACH-101299]

**Responsible:** Prof. Dr.-Ing. Sven Matthiesen  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** Fundamentals of Scientific Engineering

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<td>Each winter term</td>
<td>2 terms</td>
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**Mandatory**

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<tr>
<td>T-MACH-112225</td>
<td>Mechanical Design I and II</td>
<td>7 CR</td>
<td>Matthiesen</td>
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<tr>
<td>T-MACH-112226</td>
<td>Mechanical Design I, Tutorial</td>
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<tr>
<td>T-MACH-112227</td>
<td>Mechanical Design II, Tutorial</td>
<td>1 CR</td>
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</tbody>
</table>

**Competence Certificate**

Written examination on the contents of Mechanical Design I&II  
Duration: 90 min plus reading time  
Preliminary examination: Successful participation in the preliminary work in the field of Mechanical Design I&II

**Prerequisites**

None
**Competence Goal**

**Learning objects springs:**
- be able to recognize spring types and explain stress
- Identify and describe the properties of a resilient LSS in machine elements presented later on
- Understanding and explaining the principle of action
- Know and list areas of application for springs
- graphically illustrate the load and the resulting stresses
- be able to describe the degree of species usefulness as a means of lightweight construction
- be able to analyse different solution variants with regard to lightweight construction (use species efficiency)
- Being able to explain several springs as a circuit and calculate total spring stiffness

**Learning objects Technical Systems:**
- Being able to explain what a technical system is
- "Thinking in systems."
- Using system technology as an abstraction tool for handling complexity
- Recognizing functional relationships of technical systems
- Getting to know the concept of function
- be able to use C&C²-A as a means of system technology

**Learning objects Visualization:**
- Ability to create and interpret schematics
- Using freehand technical drawing as a means of communication
- To be able to apply the technical basics of freehand drawing
- Derivation of 2D representations into different perspective representations of technical structures and vice versa
- Master reading of technical drawings
- Dedicated dimensioning of technical drawings
- Create sectional views of technical systems as a technical sketch

**Learning objects Bearings:**
- be able to recognize bearings in machine systems and explain their basic functions
- name bearings (type/type/function) and recognize them in machine systems and technical drawings
- Being able to name areas of application and selection criteria for the various bearings and bearing arrangements and explain interrelationships
- Ability to functionally explain the design of the bearing definitions in different directions radially/axially and circumferentially
- Know and describe selection as an iterative process as an example
- be able to perform dimensioning of bearing arrangements as an example of the engineer's approach to dimensioning machine elements
- Develop first ideas for probabilities in predicting the life of machine elements
- Recognise from the damage pattern whether static or dynamic overload was the cause of material failure
- Calculate equivalent static and dynamic bearing loads from the catalogue and given external forces on the bearing
- Being able to name, explain and transfer the basic equation of the dimensioning to the bearing dimensioning

**Learning objectives seals:**

The students...
- can discuss the basic functions of seals
- can describe the physical causes for mass transfer
- can apply the C&C-Model on seals
- can name, describe and apply the three most important classification criteria of seals
- can explain the function of a contacting seal and a non-contacting seal.
- can differentiate the seal types and organize them to the classification criteria.
- can discuss the structure and the effect of a radial shaft seal
- can evaluate radial shaft seals, compression packings, mechanical seals, gap seals and labyrinth seals
- can describe and apply the constructional principle of selffortification
- can describe the stick-slip phenomenon during the movement sequences of a reciprocating seal

**Learning design:**

The students...
- understand the meaning of design
- are able to recognize and implement basic rules and principles of design
- are able to design the connection of partial systems into the total system
- can name requirements of design and take them into account
- know the main groups of manufacturing methods
• are able to explain the manufacturing processes
• are able to depict a casted design in a drawing clearly, e.g. draft of the mold, no material accumulation, ...
• know how components are designed
• Know how the production of the components has an effect on
  their design
• Know the requirements and boundary conditions on design

Learning bolted connections:
The students...

• can list and explain various bolt applications.
• can recognize bolt types and explain their function
• can build a C&C² model of a bolted joint and discuss the influences on its function
• can explain the function of a bolted connection with the help of a spring model
• can reproduce, apply and discuss the screw equation.
• Can estimate the load-bearing capacity of low-loaded bolted joints for dimensioning purposes
• Can indicate which bolted joint is to be calculated and which only roughly dimensioned.
• Can carry out the dimensioning of bolted connections as flange connections
• Can create, explain and discuss the force deflection diagram of a bolted connection

Content
MKL I:
Introduction to product development
Tools for visualization (technical drawing)
Product creation as a problem solution
Technical Systems Product Development

• Systems theorie
• Contact and Channel Approach C&C²-A

Basics of selected construction and machine elements

• Federn
• bearings and fence
• sealings

The lecture is accompanied by exercises with the following content:
gear workshop
Tools for visualization (technical drawing)
Technical Systems Product Development

• Systemtheorie
• Contact and Channel Approach C&C²-A

Exercises for springs
Exercises for bearings and fence

MKL II:

• sealings
• design
• dimensioning
• component connections
• bolts
Workload
MKL1:
Presence: 33.5 h
Attendance in lectures: 15 * 1.5 h = 22.5 h
Presence in exercises: 8 * 1.5 h = 12 h
Self-study: 56.5 h
Personal preparation and wrap-up of lecture and exercises including the processing of the test certificates and preparation for the exam: 56.5 h
Total: 90 h = 3 LP
MKL2:
Presence: 33 h
Attendance in lectures: 15 * 1.5 h = 22.5 h
Presence in exercises: 7 * 1.5 h = 10.5 h
Self study: 87 h
Personal preparation and wrap-up of lectures and exercises, including the processing of the test certificates and preparation for the exam: 87 h
Total: 150 h = 5 LP
Additional expenditure for degree programs from other disciplines MKL1 + MKL2 in total: 30 h = 1 LP
4.39 Module: Mechanical Design III and IV [M-MACH-102829]

**Responsible:** Prof. Dr.-Ing. Albert Albers  
Prof. Dr.-Ing. Sven Matthiesen

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** Mandatory Elective Courses

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**Competence Certificate**

Written examination, consisting of theoretical and constructive part.  
The theoretical examination lasts 1 hour plus reading time.  
The constructional examination takes 3 hours plus reading time.  
Both parts of the examination must be passed in order to pass the overall examination for machine design apprenticeship III+IV.

**Prerequisites**

None

**Competence Goal**

In mechanical design, students acquire skills in analysis and synthesis using examples (= leading examples). The examples include individual machine elements such as bearings or springs as well as more complex systems such as gears or clutches. After completing the machine design course, the students can apply the learned contents to further technical systems - even those not known from the lecture - by transferring the exemplary learned operating principles and basic functions to other contexts. This enables students to independently analyze unknown technical systems and to synthesize systems suitable for given problems.

**Content**

tolerances and fits  
component connections  
gears  
basics of component dimensioning  
shaft clutches  
fundamentals of fluid technology  
electrical machines
Workload
MKL 3:
Presence: 45 h
Attendance time lecture (15 L): 22,5h
Attendance time exercises (7 exercises): 10,5h
Attendance time milestones project work (3x 4h): 12h
Self-study: 135h
Project work in a team: 90h
Personal preparation and follow-up of lecture and exercise: 45h
MKL 4:
Presence: 40,5 h
Attendance lectures (13 L): 19,5h
Attendance time exercises (6 exercises): 9h
Attendance time milestones project work (3x 4h): 12h
Self-study: 169,5 h
Project work in a team: 105h
Personal preparation and follow-up of lecture and exercise, incl. preparation for the exam: 64,5h
Total: 390 h = 13 LP

Learning type
Lecture
Tutorial
Project work during the semester
Module: Mechanical Processing [M-CIWVT-101135]

**M Mandatory**

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**Responsible:** Prof. Dr.-Ing. Achim Dittler

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

**Part of:** Fundamentals of Process Engineering

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**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
- Fundamentals of agglomeration
- Fundamentals of storage and conveyance

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

**Workload**
Lectures and exercises: 60 h
Self-study: 45 h (about three hours per week)
Preparation of examination: 75 h

**Recommendation**
Courses of 1st - 4th semester

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

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Success control is a written examination, 120 minutes duration, according to § 4 Abs. 2 No. 1 SPO.
4.41 Module: Mechanical Separation Technology [M-CIWVT-101147]

**Responsible:** Dr.-Ing. Marco Gleiß

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

**Part of:** Specialization/ Project Work

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**Competence Certificate**

The control of success in this module comprises 2 graded major course assessments according to §4 para.2 Nr.3 of the SPO:

1. An oral individual examination with a volume of about 30 minutes for the lecture “22987 Mechanical Separation Technology” and “22988 Exercises to 22987”

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

The module grade is calculated from the LP-weighted mean of both parts of the module.

Each of the course has to be passed ("ausreichend"). A failed course can be repeated one time, according to the SPO § 9 (2) - (6).

**Prerequisites**

Participation requires

- minimum 60 ECTS
- minimum 1 lab course

**Modeled Conditions**

The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in the following fields:
   - Fundamentals of Scientific Engineering
   - Fundamentals of Mathematics and Natural Sciences
   - Laboratories
   - Thermodynamics and Transport Processes
   - Interdisciplinary Qualifications
   - Fundamentals of Process Engineering
   - Mandatory Elective Courses

**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 between 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 apparatuses and machines; apparatus combinations; case studies to solve separation problems.

**Module grade calculation**

The module grade is calculated from the LP-weighted mean of both parts of the module.
Workload
lecture 3SWH, exercises 1SWH, presence time: 60h
self-study: 80h
examination preparation: 80h
project work presence time and self-study: 140h

Recommendation
Modules of 1st - 4th semester

Literature
Anlauf: Script "Mechanische Separationstechnik - Fest/Flüssig-Trennung"
**Module: Micro Process Engineering [M-CIWVT-101154]**

**Responsible:** Prof. Dr.-Ing. Peter Pfeifer

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

**Part of:** Specialization/ Project Work

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<tr>
<th>Credits</th>
<th>Grading scale</th>
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<th>Duration</th>
<th>Language</th>
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</table>

**Competence Certificate**

The module comprises two success controls according to § 4(2) No 2,3 SPO:

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

Each of the course has to be passed ("ausreichend"). A failed course can be repeated one time, according to the SPO § 9 (2) - (6).

**Prerequisites**

Participation requires:

- minimum 60 ECTS
- minimum 1 lab course

**Modeled Conditions**

The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in the following fields:
   - Fundamentals of Scientific Engineering
   - Fundamentals of Mathematics and Natural Sciences
   - Laboratories
   - Thermodynamics and Transport Processes
   - Interdisciplinary Qualifications
   - Fundamentals of Process Engineering
   - Mandatory Elective Courses

**Competence Goal**

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

**Content**

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.

**Workload**

360 h

**Recommendation**

Courses of 1st - 4th semester
Literature
Scriptum (slides collection), text books:
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
4.43 Module: Module Bachelor's Thesis [M-CIWVT-103204]

**Responsible:** Prof. Dr.-Ing. Achim Dittler
apl. Prof. Dr. Michael Türk

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

**Part of:** Bachelor's Thesis

<table>
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</table>

**Mandatory**

| T-CIWVT-106365 | Bachelor's Thesis | 12 CR |

**Prerequisites**

§ 14 (1) SPO

**Modeled 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

**Competence Goal**
Students are able to work on specialised problems with scientific methods independently and within a defined time frame.
4.44 Module: Organic Chemistry for Engineers [M-CHEMBIO-101115]

**Responsible:** Prof. Dr. Michael Meier

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

**Part of:** Fundamentals of Mathematics and Natural Sciences

<table>
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<tr>
<th>Credits</th>
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**Mandatory**

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

**Competence Certificate**

graded: written examination

**Prerequisites**

none

**Competence Goal**

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

**Content**

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

**Module grade calculation**

grade of the written examination

**Workload**

lectures and exercises: 34h
homework and preparation of examination: 86h

**Literature**


Module: Orientation Exam [M-CIWVT-100874]

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

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<td>Arens, Griesmaier, Hettlich</td>
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<td>T-CHEMBIO-101866</td>
<td>General and Inorganic Chemistry</td>
<td>6 CR</td>
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Modelled deadline
This module must be passed until the end of the 3. term.

Prerequisites
None

Annotation
For students who are or were enrolled in a degree program in the summer semester 2020, winter semester 2020/2021, summer semester 2021, or winter semester 2021/2022, the deadline for taking the orientation exam has been extended by one semester in each case (section 32 (5 a), sentence 1 LHG).
This means that the deadline has been extended for

- students enrolled in one of the above semesters in the same program by one semester;
- students enrolled in two of the above semesters in the same program by two semesters;
- students enrolled in three or more of the above semesters in the same program by a maximum of three semesters.
Module: Particle Technology [M-CIWVT-101141]

**Responsible:** Prof. Dr.-Ing. Achim Dittler

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

**Part of:** Specialization/ Project Work

**Credits:** 12

**Grading scale:** Grade to a tenth

**Recurrence:** Each winter term

**Duration:** 2 terms

**Language:** German

**Level:** 4

**Version:** 2

**Mandatory**

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**Competence Certificate**
The Module comprises two graded success controls according to § 4 (2) No 2,3 SPO:
1. oral examination, duration 30 minutes (60 %)
2. project work (60 %)

Each of the course has to be passed ("ausreichend"). A failed course can be repeated one time, according to the SPO § 9 (2) - (6).

**Prerequisites**
Participation requires

- minimum 60 ECTS
- minimum 1 lab course

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

1. You need to have earned at least 60 credits in the following fields:
   - Fundamentals of Scientific Engineering
   - Fundamentals of Mathematics and Natural Sciences
   - Laboritories
   - Thermodynamics and Transport Processes
   - Interdisciplinary Qualifications
   - Fundamentals of Process Engineering
   - Mandatory Elective Courses

**Competence Goal**
Students understand 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.

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

**Recommendation**
Courses of 1st - 4th semester

**Literature**
Skriptum Gas-Partikel-Messtechnik
Module: Practical Course in Organic Chemistry for Chemical Engineers [M-CHEMBIO-101116]

**Responsibility:** Dr. Andreas Rapp

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

**Part of:** Laboratories

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**Competence Certificate**
protools 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. distillation, 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
4.48 Module: Process Development and Scale-up [M-CIWVT-101153]

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

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Competence Certificate
The module comprises two success controls according to § 4 (2) No 2,3 SPO:
- project work/ presentation and report
- Online-tests (prerequisite for oral examination)
- individual oral examination, duration 30 minutes

The module grade is calculated from the mean of both parts of the module. Additionally Online-Quick-Tests can be done accompanying the lecture. These are included in the oral examination mark with 20%.

Each of the course has to be passed ("ausreichend"). A failed course can be repeated one time, according to the SPO § 9 (2) - (6).

Prerequisites
Participation requires

- minimum 60 ECTS
- minimum 1 lab course

Modeled Conditions
The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in the following fields:
   - Fundamentals of Scientific Engineering
   - Fundamentals of Mathematics and Natural Sciences
   - Laboratories
   - Thermodynamics and Transport Processes
   - Interdisciplinary Qualifications
   - Fundamentals of Process Engineering
   - Mandatory Elective Courses

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 independent scientific work.

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

Module grade calculation
50 % oral examination, 50 % project work.
Annotation
As part of the project study a visit to the IKFT and the bioliq plant at the Campus North is intended.

Workload
Lecture and Exercise:
Attendance time: 45 h
Self-study: 90 h
Exam preparation: 45 h
Project work: 180 h

Recommendation
Courses of 1st - 4th semester

Literature
Belbin, R.M., Management Teams, Why They Succeed or Fail, Routledge, NY, 2013.
M 4.49 Module: Process Machines [M-CIWVT-101139]

**Responsible:** Prof. Dr.-Ing. Hermann Nirschl

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

**Part of:** Laboratories

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**Mandatory**

| T-CIWVT-101903 | Laboratory Work Process Machines | 5 CR | Gleiß |

**Competence Certificate**

not graded, passed/not passed 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**

pumps, electroseparator, power input into stirred vessels, heat transfer in and out stirred vessels, refrigerator/heat pump, heat transfer co-current and counter-current, error calculation, emulsification/ice cream machine, flow-characteristics of emulsions, biomass-transport in a scww-reactor

**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
4.50 Module: Rheology and Product Design [M-CIWVT-101144]

**Responsible:** Dr.-Ing. Claude Oelschlaeger

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

**Part of:** Specialization/ Project Work

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**Competence Certificate**
The module comprises two grades success controls according to § 4 (2) No 2,3 SPO:
- project work (teamwise)
- oral examinations (courses)

The oral examinations have to be passed as a precondition for project work. Overall grade of the module: average weighted according to the credit points.

1/3 project work
2/3 oral examinations

Each of the course has to be passed ("ausreichend"). A failed course can be repeated one time, according to the SPO § 9 (2) - (6) of SPO.

**Prerequisites**
Participation requires

- minimum 60 ECTS
- minimum 1 lab course

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

1. You need to have earned at least 60 credits in the following fields:
   - Fundamentals of Scientific Engineering
   - Fundamentals of Mathematics and Natural Sciences
   - Laboratories
   - Thermodynamics and Transport Processes
   - Interdisciplinary Qualifications
   - Fundamentals of Process Engineering
   - Mandatory Elective Courses

**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 an colloidal stability of disperse systems. Applying this knowledge in context of their project work. They gather experience in team-oriented 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 taught in the lecture "Basics of Product Design". In the lecture "Fabrications an characterization of dispersions and emulsions" this systematics is elaborated in a more specific manner. The application of this systematics is practiced on specific case studies.

**Module grade calculation**
final grade = 2/3 x oral examination + 1/3 x project work

**Workload**
- lectures and exercises: 135h
- homework and preparation of examination: 225h
Literature
Scriptum, articles out of scientific journals, text books:
Lagaly/Schulz/Zimehl: Dispersionen und Emulsionen, Steinkopff (1997),
Barnes/Hutton/Walters: An Introduction to Rheology, Elsevier (1989),
## 4.51 Module: Single Results [M-CIWVT-101992]

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

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### Master Transfer Examinations (Election: at least 30 credits)

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<td>Thermal Transport Processes</td>
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<td>Biopharmaceutical Purification Processes</td>
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<td>T-CIWVT-110865</td>
<td>Membrane Technologies in Water Treatment</td>
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### Prerequisites

None
## M 4.52 Module: SmartMentoring [M-CIWVT-105848]

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

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

**Responsible:** Prof. Dr.-Ing. Matthias Kind

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

**Part of:** Fundamentals of Process Engineering

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**Mandatory**

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

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

**Prerequisites**
None

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

**Content**
The taught 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**
Attendance time (lecture and tutorials): 56 h
Self study: 44 h
Examination preparation: 80 h

**Recommendation**
Courses of 1st - 4th semester

**Literature**
personal prints, scientific text books
4.54 Module: Thermodynamics I [M-CIWVT-101129]

**Responsible:** Prof. Dr. Sabine Enders

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

**Part of:** Thermodynamics and Transport Processes

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<td>Thermodynamics I, Exam</td>
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**Competence Certificate**

Written examination 120 min
Precondition for participation: 2 of 3 compulsory exercises have to be approved

**Prerequisites**

none

**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**

grade of the written examination

**Workload**

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

**Recommendation**

courses of 1st and 2nd semester

**Literature**

Schaber, K.: Skriptum Thermodynamik I (www.ttk.uni-karlsruhe.de)
Sandler, S. I.: Chemical, Biochemical and Engineering Thermodynamics, J. Wiley & Sons, 2006
4.55 Module: Thermodynamics II [M-CIWVT-101130]

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

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**Competence Certificate**  
Written examination 120 min  
Precondition for participation: 2 of 3 compulsory exercises have to be approved

**Prerequisites**  
none

**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**  
Grade of the written examination

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

**Recommendation**  
courses of 1st - 3rd semester  
Thermodynamics I

**Literature**  
Sandler, S. I.: Chemical, Biochemical and Engineering Thermodynamics, J. Wiley & Sons, 2006  

**Responsible:** Prof. Dr. Harald Horn

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

**Part of:** Specialization/ Project Work

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<td>T-CIWVT-103651</td>
<td>Water Quality and Process Engineering of Water and Waste Water Treatment</td>
<td>4 CR</td>
<td>Hille-Reichel, Horn</td>
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**Competence Certificate**

There is an oral examination of the lectures and a grading of the project thesis. The overall grade of the module is taken as an average from the individual grades of the oral examination of the lectures and of the project thesis, weighted according to the credit points.

Lectures: overall oral examination of 30 min according to § 4 Abs. 2 No 2 SPO of the lectures “22603 Scientific Principles for Water Quality Assessment” and “22607 Water Quality and Process Engineering of Water and Waste Water Treatment”.

Project thesis: individual grades of the written report and the oral presentation, according to § 4 Abs. 2 No. 3 SPO.

Each of the course has to be passed (“ausreichend”). A failed course can be repeated one time, according to the SPO 9 (2) - (6).

**Prerequisites**

Participation requires

- minimum 60 ECTS
- minimum 1 lab course

**Modeled Conditions**

The following conditions have to be fulfilled:

1. You need to have earned at least 60 credits in the following fields:
   - Fundamentals of Scientific Engineering
   - Fundamentals of Mathematics and Natural Sciences
   - Laboratories
   - Thermodynamics and Transport Processes
   - Interdisciplinary Qualifications
   - Fundamentals of Process Engineering
   - Mandatory Elective Courses

**Competence Goal**

The students can explain the basic processes of drinking water supply and waste water treatment. They can describe and apply the basic principles and the criteria for water quality assessment. They can perform calculations, and can evaluate, compare and interpret the data and the results. They are able to use the methodical tools and to analyze the context.

**Content**

Hydrological cycle: different sources and needs, water treatment, water supply, water quality, analytical tools for quality assessment, practical thesis to optimize a treatment step, including experimental lab work, application of different tools for analysis, excursions to drinking water treatment plants and to waste water treatment plants.

**Module grade calculation**

The overall grade of the module is taken as an average from the individual grades of the oral examination of the lectures and of the project thesis, weighted according to the credit points.
Workload
Attendance time: 60 h  Self-study: 60 h
Exam preparation: 60 h
Practical course: 40 h lab, 80 h self-study/report

Recommendation
Courses of 1st - 4th semester

Literature
- Frimmel (1998): Wasser und Gewässer, Spektrum Verlag, Heidelberg
- Crittenden et al. (2012): Water Treatment, Principles and Design. 3. Auflage, Wiley & Sons, Hoboken
- Scriptum of the lectures will be available in ILIAS (ILIAS Studierendenportal)
- Script of the lab work
5 Courses

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

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

**Organisation:**
KIT Department of Mathematics

**Part of:**
- M-CIWVT-100874 - Orientation Exam
- M-MATH-100280 - Advanced Mathematics I

### Events

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

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

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

1. The course T-MATH-100525 - Tutorial Advanced Mathematics I must have been passed.
### 5.2 Course: Advanced Mathematics II [T-MATH-100276]

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

**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-100281 - Advanced Mathematics II

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**Competence Certificate**

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

**Prerequisites**

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

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-MATH-100526 - Tutorial Advanced Mathematics II must have been passed.
5.3 Course: Advanced Mathematics III [T-MATH-100277]

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

**Organisation:** KIT Department of Mathematics

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

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**Learning Certificate**

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

**Prerequisites**

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

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-MATH-100527 - Tutorial Advanced Mathematics III must have been passed.
# 5.4 Course: Application of Numerics in Engineering [T-CIWVT-101876]

**Responsible:** Prof. Dr.-Ing. Dimosthenis Trimis  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** M-CIWVT-101956 - Computational Methods

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), ⬗ On-Site, ✗ Cancelled

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

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

1. The course T-MATH-102250 - Introduction to Informatics and Algorithmic Mathematics - Exam must have been started.
5.5 Course: Applied Apparatus Engineering [T-CIWVT-106562]

### Responsible
Dr. Martin Neuberger

### Organisation
KIT Department of Chemical and Process Engineering

### Part of
M-CIWVT-103297 - Applied Apparatus Engineering

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), ♦ On-Site, x Cancelled

### Competence Certificate
Learning Control is a written examination, 90 minutes duration.

### Prerequisites
None
5 COURSES


Responsible: Dr.-Ing. Benjamin Dietrich
Dr. Philip Scharfer

Organisation: KIT Department of Chemical and Process Engineering

Part of: M-CIWVT-104458 - Applied Thermal Process Engineering

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

Prerequisites
None
### 5.7 Course: Applied Thermal Process Engineering - Project Work [T-CIWVT-109120]

**Responsible:** Dr.-Ing. Benjamin Dietrich  
Dr. Philip Scharfer  

**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** M-CIWVT-104458 - Applied Thermal Process Engineering

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

**Prerequisites**

None
### 5.8 Course: Bachelor's Thesis [T-CIWVT-106365]

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

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

- **Submission deadline**: 4 months  
- **Maximum extension period**: 2 weeks  
- **Correction period**: 6 weeks
5.9 Course: Biochemistry [T-CIWVT-111064]

**Responsible:** Dr. Jens Rudat

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

**Part of:** M-CIWVT-105518 - Enzyme Technology

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| ST 2022 | 22406 | **Biology for Engineers II** | 2 SWS | Lecture / 🗓️ | Rudat |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗓️ On-Site, ✗ Cancelled

**Competence Certificate**

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

**Prerequisites**

None
5.10 Course: Biopharmaceutical Purification Processes [T-CIWVT-106029]

**Responsible:** Prof. Dr.-Ing. Jürgen Hubbuch  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** M-CIWVT-101992 - Single Results

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**Legend:** 🕒 Online, 🛑 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**  
The examination is a written examination with a duration of 120 minutes (section 4 subsection 2 number 1 SPO).
5 COURSES

Course: Bioprocess Engineering [T-CIWVT-110128]

5.11 Course: Bioprocess Engineering [T-CIWVT-110128]

**Responsible:** apl. Prof. Dr. Matthias Franzreb
Prof. Dr. Harald Horn
Prof. Dr.-Ing. Jürgen Hubbuch

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

**Part of:** M-CIWVT-105517 - Industrial Microbiology

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗑 On-Site, ☑ Cancelled

**Competence Certificate**

Written examination with a duration of 120 minutes (section 4 subsection 2 No. 1 SPO).
5.12 Course: Biotechnological Production [T-CIWVT-106030]

**Responsible:** Prof. Dr. Christoph Syldatk

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

**Part of:** M-CIWVT-101992 - Single Results

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**Legend:** 🖥 Online, 🧱 Blended (On-Site/Online), 🗣 On-Site, ⏹ Cancelled

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-CIWVT-108492 - Seminar Biotechnological Production must have been passed.
5.13 Course: Biotechnology [T-CIWVT-103668]

**Responsible:** Dr. Michael Wörner

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

**Part of:** M-CIWVT-101143 - Biotechnology

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**Prerequisites**

None
5.14 Course: Biotechnology [T-CIWVT-103669]

**Responsible:** Dr.-Ing. Iris Perner-Nochta

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

**Part of:** M-CIWVT-101143 - Biotechnology

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**Prerequisites**

None

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗑 On-Site, ✗ Cancelled
5.15 Course: Catalysts for the Energy Transition [T-CIWVT-112214]

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

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

Competence Certificate
Oral exam, duration approx. 20 minutes.

Prerequisites
None.
### 5.16 Course: Cell Biology [T-CIWVT-111062]

- **Responsible:** apl. Prof. Dr. Hans-Eric Gottwald
- **Organisation:** KIT Department of Chemical and Process Engineering
- **Part of:** M-CIWVT-101624 - Biology for Engineers I

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

**Prerequisites**
None
5.17 Course: Chemical Process Engineering [T-CIWVT-101884]

**Responsible:** Prof. Dr. Bettina Kraushaar-Czarnetzki

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

**Part of:** M-CIWVT-101133 - Chemical Process Engineering

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<td>22102</td>
<td>Übung zu 22101 Chemische Verfahrenstechnik (Bach.)</td>
<td>2 SWS Practice</td>
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Legend: 🖥 Online, ☭ Blended (On-Site/Online), ☭ On-Site, ✗ Cancelled

**Prerequisites**

None
5.18 Course: Circular Economy - Oral Exam [T-CIWVT-112172]

**Responsible:** Prof. Dr.-Ing. Dieter Stapf

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

**Part of:** M-CIWVT-105995 - Circular Economy

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

**Competence Certificate**

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

**Prerequisites**

None.
### 5.19 Course: Circular Economy - Project Work [T-CIWVT-112173]

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

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

**Prerequisites**  
None.
# 5.20 Course: Computational Fluid Dynamics [T-CIWVT-106035]

**Responsible:** Prof. Dr.-Ing. Hermann Nirschl  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** M-CIWVT-101992 - Single Results

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<td>Übungen zu 22958 Numerische Strömungssimulation (in kleinen Gruppen)</td>
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Legend: 🖥 Online, ☺ Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled
# 5.21 Course: Control Engineering and System Dynamics [T-MACH-102126]

**Responsible:** Prof. Dr.-Ing. Christoph Stiller  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-101300 - Control Engineering and System Dynamics

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

**Competence Certificate**

written exam

**Prerequisites**

none
### Course: Downstream Processing [T-CIWVT-101897]

**Responsible:** Prof. Dr.-Ing. Jürgen Hubbuch

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

**Part of:** M-CIWVT-105698 - Downstream Processing

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<td>Hubbuch, und Mitarbeiter</td>
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**Prerequisites**

None
5.23 Course: Electrochemical Energy Technologies [T-ETIT-111352]

**Responsible:** Prof. Dr.-Ing. Ulrike Krewer

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

**Part of:** M-ETIT-105690 - Electrochemical Energy Technologies

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

**Competence Certificate**

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

**Prerequisites**

none
### 5.24 Course: Elementary Physics [T-PHYS-101577]

**Responsible:** Prof. Dr. Markus Klute  
**Organisation:** KIT Department of Physics  
**Part of:** M-PHYS-100993 - Elementary Physics

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<td>Klute</td>
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<td>Übungen zu Physikalische Grundlagen für Chemie- und Bioingenieure und Verfahrenstechniker</td>
<td>2</td>
<td>Practice</td>
<td>Klute, Waßmer</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Competence Certificate**
Written exam (usually about 180 min)
5.25 Course: Energy and Environmental Engineering [T-CIWVT-108254]

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

**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** M-CIWVT-101145 - Energy and Environmental Engineering

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<td>Verfahren zur Erzeugung chemischer Energieträger</td>
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<td>Lecture / Online</td>
<td>Rauch</td>
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<td>WT 22/23</td>
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<td>Fundamentals of High Temperature Energy Conversion</td>
<td>2 SWS</td>
<td>Lecture / Online</td>
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**Prerequisites**
None

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled
5.26 Course: Energy and Environmental Engineering Project Work [T-CIWVT-103527]

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

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

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

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

**Prerequisites**  
None
### 5.27 Course: Energy Process Engineering [T-CIWVT-101889]

**Responsible:** Prof. Dr.-Ing. Thomas Kolb  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** M-CIWVT-101136 - Energy Process Engineering

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<td>Practice / 🗣</td>
<td>Kolb, Trimis, und Mitarbeiter</td>
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**Prerequisites**  
None

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled
### 5.28 Course: Engineering Mechanics: Dynamics [T-CIWVT-106290]

**Responsible:** Prof. Dr.-Ing. Roland Dittmeyer  
TT-Prof. Dr. Christoph Klahn

**Organisation:** KIT Department of Chemical and Process Engineering  
Part of: M-CIWVT-101128 - Engineering Mechanics: Dynamics

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| WT 22/23  | 22112 | Engineering Mechanics: Dynamics | 2 SWS | Lecture / 🗣 | Dittmeyer |
| WT 22/23  | 22113 | Übungen zu Technische Mechanik: Dynamik | 2 SWS | Practice / 🗣 | Klahn |
| WT 22/23  | 22114 | Tutorium zu Technische Mechanik: Dynamik | 1 SWS | Tutorial ( / 🗣 | Dittmeyer |

Legend: 🖥 Online, 🙋 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled
5.29 Course: Engineering Mechanics: Dynamics, Exam [T-CIWVT-101877]

**Responsible:** Prof. Dr.-Ing. Roland Dittmeyer

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

**Part of:** M-CIWVT-101128 - Engineering Mechanics: Dynamics

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**Credits:** 5

**Grading scale:** Grade to a third

**Recurrence:** Each term

**Version:** 2

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

**Prerequisites**

None

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-CIWVT-106290 - Engineering Mechanics: Dynamics must have been passed.
### 5.30 Course: Engineering Mechanics: Statics [T-CIWVT-111054]

**Responsible:** Dr.-Ing. Bernhard Hochstein  
Prof. Dr. Norbert Willenbacher  

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

**Part of:** M-CIWVT-104006 - Engineering Mechanics: Statics and Strength of Materials

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**Prerequisites**  
None

*Legend: 🖥 Online, 🦜 Blended (On-Site/Online), 📔 On-Site, ✗ Cancelled*

**Responsible:** Dr.-Ing. Bernhard Hochstein  
Prof. Dr. Norbert Willenbacher

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

**Part of:** M-CIWVT-104006 - Engineering Mechanics: Statics and Strength of Materials

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<td>2 SWS</td>
<td>Lecture / 🗣</td>
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<td>ST 2022</td>
<td>22915</td>
<td>Technische Mechanik - Fragen und Antworten zu Festigkeitslehre</td>
<td>2 SWS</td>
<td>Others (sons / 🗣)</td>
<td>Hochstein</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Prerequisites**
None
5.32 Course: Enzyme Technology [T-CIWVT-111074]

Responsible: Prof. Dr. Christoph Syldatk
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-105518 - Enzyme Technology

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

Prerequisites
None
5.33 Course: Ethics [T-CIWVT-112373]

**Responsible:** Prof. Dr. Dr. Rafaela Hillerbrand

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

**Part of:** M-CIWVT-101149 - Ethics and Global Material Cycles

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**Events**

| ST 2022 | 22330 | Ethik und Stoffkreisläufe | 2 SWS | Lecture / 🗣 | Hillerbrand, Rauch |

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

**Prerequisites**

None.
5.34 Course: Examination Material Science I & II [T-MACH-105148]

**Responsible:** Dr.-Ing. Johannes Schneider  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-102567 - Material Science and Engineering

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Legend: 🛥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**
oral; 30 to 40 minutes

No tools and reference tools are allowed!

**Prerequisites**
none
5.35 Course: Excursions: Membrane Technologies [T-CIWVT-110864]

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

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

**Part of:** M-CIWVT-101992 - Single Results

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**Events**

| ST 2022 | 22606 | Practical in Membrane Technologies in Water Treatment | 1 SWS | Practice | Horn, Saravia, und Mitarbeiter |

Legend: 🖥 Online, 🪞 Blended (On-Site/Online), 🗣 On-Site, ⌚ Cancelled
5.36 Course: Exercises Process Development and Scale-up [T-CIWVT-111005]

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

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### 5.37 Course: Fluiddynamics, Exam [T-CIWVT-101882]

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

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<td>Practical in Fluiddynamics</td>
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**Legend:**  
🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

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

1. The course T-CIWVT-101904 - *Fluiddynamics, Tutorial* must have been passed.
5.38 Course: Fluiddynamics, Tutorial [T-CIWVT-101904]

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

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Legend: 🖥 Online, ☀ Blended (On-Site/Online), 🗣️ On-Site, ✗ Cancelled
5.39 Course: Food Biotechnology [T-CIWVT-101898]

**Responsible:** Prof. Dr.-Ing. Heike Karbstein

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

**Part of:** M-CIWVT-101126 - Food Biotechnology

<table>
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<th>Lecture / 🧩</th>
<th>Karbstein</th>
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<td>Übung Lebensmittelbiotechnologie (Bachelor BIW) (22227)</td>
<td>1 SWS</td>
<td>Practice / 🧩</td>
<td>Karbstein, Rütten</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗺 On-Site, ❌ Cancelled

**Competence Certificate**

This module is sucessfully completed by a written exam of 120 min (according to § 4 Abs. 2 Nr. 1 SPO).

**Prerequisites**

The Pre-Condition must be passed.

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-CIWVT-101899 - Food Biotechnology - Prerequisite must have been passed.
5.40 Course: Food Biotechnology - Prerequisite [T-CIWVT-101899]

**Responsible:** Prof. Dr.-Ing. Heike Karbstein

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

**Part of:** M-CIWVT-101126 - Food Biotechnology

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**Events**

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<td>Karbstein, Rütten</td>
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**Legend:** 🏠 Online, 🧩 Blended (On-Site/Online), 🗺 On-Site, 🔴 Cancelled

**Prerequisites**

none
5.41 Course: Food Technology [T-CIWVT-103528]

**Responsible:** Prof. Dr.-Ing. Heike Karbstein

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

**Part of:** M-CIWVT-101148 - Food Technology

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<td>Practice / 🗣</td>
<td>Emin, und Mitarbeiter</td>
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<td>Lecture / 🗣</td>
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<td>1 SWS</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**
Die Erfolgskontrolle ist eine schriftliche Prüfung im Umfang von 45 Minuten zu den Inhalten der Lehrveranstaltungen 22230, 22231 und 22232.

**Prerequisites**
None.
5.42 Course: Food Technology Project Work [T-CIWVT-103529]

**Responsible:** Prof. Dr.-Ing. Heike Karbstein

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

**Part of:** M-CIWVT-101148 - Food Technology

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

**Prerequisites**

None
5.43 Course: Fundamentals of Heat and Mass Transfer [T-CIWVT-101883]

**Responsible:** Prof. Dr.-Ing. Wilhelm Schabel  
Prof. Dr.-Ing. Thomas Wetzel  

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

**Part of:** M-CIWVT-101132 - Fundamentals of Heat and Mass Transfer

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

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<td>Lecture / 🗓</td>
<td>Wetzel, Schabel</td>
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<td>ST 2022 22831</td>
<td>Übung zu Wärme- und Stoffübertragung (22830)</td>
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<td>Practice / 🗓</td>
<td>Wetzel, Schabel, und Mitarbeiter</td>
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**Legend:**  
- 🖥 Online  
- 🧩 Blended (On-Site/Online)  
- 🗓 On-Site  
- ✗ Cancelled
Course: Fundamentals of Refrigeration, oral examination [T-CIWVT-109117]

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

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

**Events**

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<td>Refrigeration A - Exercises</td>
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<td>Grohmann, und Mitarbeiter</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**
Learning Control is an oral examination about the lecture "Grundlagen der Kältetechnik", duration about 30 minutes.

**Prerequisites**
Projects Work

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

1. The course T-CIWVT-109118 - Fundamentals of Refrigeration, Project Work must have been started.
5.45 Course: Fundamentals of Refrigeration, Project Work [T-CIWVT-109118]

**Responsible:** Prof. Dr.-Ing. Steffen Grohmann

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

**Part of:** M-CIWVT-104457 - Fundamentals of Refrigeration

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**Events**

| ST 2022 | 22046 | Projektarbeit zum Profilfach Thermodynamik und Kältetechnik | 2 SWS | Practice / 🗣 | Grohmann |

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

**Prerequisites**

None
### 5.46 Course: General and Inorganic Chemistry [T-CHEMBIO-101866]

**Responsible:** 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

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*Legend: 🖥 Online, ☑ Blended (On-Site/Online), 🗣 On-Site, ☑ Cancelled*
5.47 Course: Genetics [T-CIWVT-111063]

**Responsible:** Dr. Anke Neumann

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

**Part of:** M-CIWVT-101624 - Biology for Engineers I

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

**Prerequisites**
None
**5.48 Course: Global Material Cycles [T-CIWVT-112372]**

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

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<th>Lecture / 🗣</th>
<th>Hillerbrand, Rauch</th>
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Legend: 🖥 Online, ☑ Blended (On-Site/Online), 🗣 On-Site, 🗿 Cancelled

**Prerequisites**

None.
5.49 Course: Industrial Business Administration [T-WIWI-100796]

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

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<th>Recurrence</th>
<th>Each winter term</th>
<th>Version</th>
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Events

| WT 22/23 | 2581040 | **Industrial Business Administration** | 2 SWS | Lecture / 🗣 | Fichtner |

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

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

**Prerequisites**  
None
5.50 Course: Industrial Organic Chemistry [T-CIWVT-101890]

**Responsible:** Prof. Dr.-Ing. Jürgen Hubbuch  
Prof. Dr. Reinhard Rauch  
Dr. Michael Wörner

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

**Part of:** M-CIWVT-101137 - Industrial Organic Chemistry

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**Events**

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗂 On-Site, ✗ Cancelled

**Prerequisites**

None

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The module M-CHEMBIO-101115 - Organic Chemistry for Engineers must have been started.
### 5.51 Course: Initial Exam Process Technology and Plant Design [T-CIWVT-106149]

**Responsible:** Prof. Dr.-Ing. Thomas Kolb  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** M-CIWVT-101992 – Single Results

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Legend: 🖥 Online, 🎤 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled
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**Responsible:** Prof. Dr.-Ing. Clemens Posten

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

**Part of:** M-CIWVT-101992 - Single Results
## 5.53 Course: International Concepts of Water Technologies [T-CIWVT-103704]

**Responsible:** Prof. Dr. Andrea Schäfer  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** M-CIWVT-101972 - International Concepts of Water Technologies

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**International Concepts in Water Treatment**

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled
5.54 Course: internship [T-CIWVT-106036]

**Responsible:** Dr.-Ing. Siegfried Bajoeh
Dr.-Ing. Barbara Freudig

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

**Part of:** M-CIWVT-101992 - Single Results

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### 5.55 Course: Introduction to Informatics and Algorithmic Mathematics - Exam [T-MATH-102250]

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

**Organisation:** KIT Department of Mathematics

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

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled
### 5.56 Course: Kinetics and Catalysis [T-CIWVT-106032]

**Responsible:** Prof. Dr. Bettina Kraushaar-Czarnetzki  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** M-CIWVT-101992 - Single Results

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<td>Practice / 🖥</td>
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Legend: 🖥 Online, 🐈 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled
## 5.57 Course: Laboratory Course: Electrochemical Energy Technologies [T-ETIT-111376]

### Responsible:
Dr. Philipp Röse

### Organisation:
KIT Department of Electrical Engineering and Information Technology

### Part of:
M-ETIT-105703 - Laboratory Course: Electrochemical Energy Technologies

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### Events

| ST 2022 | 2313212 | Laboratory Electrochemical Energy Technologies | 3 SWS | Practical course / | Röse |

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

### Competence Certificate

The examination consists of a different kind of graded assessment including four experiments. The overall impression is rated. To pass the module, all experiments must be successfully completed. In case of failure, the laboratory course has to be repeated completely.

Attendance at the safety briefing and participation in an entry colloquium is mandatory (ungraded).

### Prerequisites

The prerequisite for admission to the module is that students have successfully passed the module "M-ETIT-105690 – Electrochemical Energy Technologies".
5.58 Course: Laboratory Work in General and Inorganic Chemistry Part I [T-CHEMBIO-101867]

**Responsible:** Prof. Dr. Helmut Ehrenberg

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

**Part of:** M-CIWVT-101964 - Laboratory Work in General and Inorganic Chemistry

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**Events**

| WT 22/23 | 5050 | Anorganisch-chemisches Praktikum für Studierende des Chemieingenieurwesens (Teil I) | 4 SWS | Practical course | Ehrenberg, Dsoke, Assistenten, Breher, Feldmann, Powell, Roesky |

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The module M-CHEMBIO-101117 - General and Inorganic Chemistry must have been passed.
**Course: Laboratory Work in General and Inorganic Chemistry Part II [T-CIWVT-108294]**

**Responsible:** Prof. Dr. Harald Horn  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** M-CIWVT-101964 - Laboratory Work in General and Inorganic Chemistry

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**Prerequisites**  
None

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

1. The module M-CHEMBIO-101117 - General and Inorganic Chemistry must have been passed.
2. The module M-CIWVT-101138 - Lab Work Process Engineering must not have been started.
3. The course T-CIWVT-108293 - Safety Instruction must have been passed.
5.60 Course: Laboratory Work Process Engineering [T-CIWVT-108292]

**Responsible:** Dr. Sokratis Sinanis  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** M-CIWVT-101138 - Lab Work Process Engineering

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**Events**

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**Modeled Conditions**

The following conditions have to be fulfilled:

1. The module M-CIWVT-101964 - Laboratory Work in General and Inorganic Chemistry must not have been started.
2. The course T-CHEMBIO-101866 - General and Inorganic Chemistry must have been passed.
3. The course T-CIWVT-108291 - Safety Instruction must have been passed.
5.61 Course: Laboratory Work Process Machines [T-CIWVT-101903]

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

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Events

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Prerequisites
Written Exam "Organic Chemistry" must be passed.

Modeled Conditions
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.
### Course: Mechanical Design I and II [T-MACH-112225]

**Responsible:** Prof. Dr.-Ing. Sven Matthiesen  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-MACH-101299 - Mechanical Design

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

**Competence Certificate**

Written Exam (90min) on the topics of MKL I and MKL II.

**Prerequisites**

The bricks "T-MACH-112226- Mechanical Design I, Tutorial" and "T-MACH-112227 - Mechanical Design II, Tutorial" must be passed successfully.
5.63 Course: Mechanical Design I, Tutorial [T-MACH-112226]

**Responsible:** Prof. Dr.-Ing. Sven Matthiesen

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-101299 - Mechanical Design

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**Legend:** 🖥 Online, ☕ Blended (On-Site/Online), 🗂 On-Site, ✗ Cancelled

**Competence Certificate**

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. Furthermore an online test is carried out.
5.64 Course: Mechanical Design II, Tutorial [T-MACH-112227]

- **Responsible:** Prof. Dr.-Ing. Sven Matthiesen
- **Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-101299 - Mechanical Design

**Type**
- Completed coursework

**Credits**
- 1

**Grading scale**
- pass/fail

**Recurrence**
- Each summer term

**Version**
- 1

**Competence Certificate**

CIW/VT/IP-M/UIING/MATH/MWT: To pass the prerequisite it is required that a design task is successfully completed.

MIT: To pass the prerequisite it is required that a design task is successfully completed.

NWT: For students of the subject area NwT, the creation of a teaching video for the teaching of a technical system must be completed as a prerequisite for the exam instead.

**Prerequisites**

None
T 5.65 Course: Mechanical Design III and IV [T-MACH-104810]

**Responsible:** Prof. Dr.-Ing. Sven Matthiesen

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102829 - Mechanical Design III and IV

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

**Competence Certificate**
written exam consisting of:

- written part duration 60 min and
- design part duration 180 min

Sum: 240 min

**Prerequisites**
Admission to the exam only with successful completion of the Mechanical Design III, Tutorial and Mechanical Design IV, Tutorial.

**Modeled Conditions**
You have to fulfill one of 2 conditions:

1. The course T-MACH-110955 - Mechanical Design III, Tutorial must have been passed.
2. The course T-MACH-110956 - Mechanical Design IV, Tutorial must have been passed.
5.66 Course: Mechanical Design III, Tutorial [T-MACH-110955]

**Responsible:** Prof. Dr.-Ing. Sven Matthiesen

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102829 - Mechanical Design III and IV

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

**Competence Certificate**
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 CAD-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
### 5.67 Course: Mechanical Design IV, Tutorial [T-MACH-110956]

**Responsible:** Prof. Dr.-Ing. Sven Matthiesen  
**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-MACH-102829 - Mechanical Design III and IV

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**Events**

| ST 2022 | 2146184 | Tutorials Mechanical Design IV | 1 SWS | Practice / 📝 | Albers, Matthiesen, Mitarbeiter |
| ST 2022 | 2146187 | Workshop 'Mechanical Design IV' | 1 SWS | / 📝 | Albers, Matthiesen, Mitarbeiter |
| ST 2022 | 3146021 | Mechanical Design IV Tutorials | 1 SWS | Practice / 📝 | Albers, Mitarbeiter |
| ST 2022 | 3146022 | Mechanical Design IV Workshop | 1 SWS | / 📝 | Albers, Mitarbeiter |

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 📝 On-Site, ❌ Cancelled

**Competence Certificate**

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

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

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

**Prerequisites**
none
## 5.69 Course: Mechanical Separation Technology Exam [T-CIWVT-103448]

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

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

### Prerequisites

None
5.70 Course: Mechanical Separation Technology Project Work [T-CIWVT-103452]

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

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**Prerequisites**

none
5.71 Course: Membrane Technologies in Water Treatment [T-CIWVT-110865]

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

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

**Part of:** M-CIWVT-101992 - Single Results

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<td>Practice / 🗣️</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, ✗ Cancelled

**Competence Certificate**
Learning control is an written examination with a duration of 90 minutes (SPO section 4 subsection 2).

**Prerequisites**
The attendance at the excursions is examination prerequisite.

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

1. The course T-CIWVT-110864 - Excursions: Membrane Technologies must have been passed.
### 5.72 Course: Micro Process Engineering [T-CIWVT-103667]

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

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<td>Projektarbeit im Profilfach Mikroverfahrenstechnik</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

Die Erfolgskontrolle ist eine Prüfungsleistung anderer Art (Projektarbeit) nach § 4 Abs. 2 Nr. 3 der SPO Bachelor Chemieingenieurwesen und Verfahrenstechnik 2015. Es werden die praktische Mitarbeit, der schriftliche Bericht sowie die mündliche Präsentation der Ergebnisse individuell bewertet.

**Prerequisites**

None
5.73 Course: Micro Process Engineering [T-CIWVT-103666]

**Responsible:** Prof. Dr.-Ing. Peter Pfeifer

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

**Part of:** M-CIWVT-101154 - Micro Process Engineering

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Legend:
- 🖥 Online
- 🧩 Blended (On-Site/Online)
- 🗑 On-Site
- ❌ Cancelled

**Competence Certificate**

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

**Prerequisites**

None
5.74 Course: Microbiology [T-CIWVT-111065]

**Responsible:** Dr. Anke Neumann  
Prof. Dr. Christoph Syldatk

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

**Part of:** M-CIWVT-105517 - Industrial Microbiology

<table>
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<th>Lecture / 🗣</th>
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Legend: 🖥 Online, ☠ Blended (On-Site/Online), 🗣 On-Site, ☐ Cancelled

**Competence Certificate**

Written Examination with a duration of 90 minutes.
5.75 Course: Organic Chemistry for Engineers [T-CHEMBIO-101865]

**Responsible:** Prof. Dr. Michael Meier

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

**Part of:** M-CHEMBIO-101115 - Organic Chemistry for Engineers

<table>
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**Events**

| ST 2022 | 5142 | Organische Chemie für CIW/VT und BIW | 2 SWS | Lecture / 🗣 | Levkin |
| ST 2022 | 5143 | Übungen zu Organische Chemie für CIW/VT und BIW | 2 SWS | Practice / 🗣 | Levkin |

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

**Prerequisites**

acc. to module catalogue
5.76 Course: Particle Technology [T-CIWVT-103654]

**Responsible:** Prof. Dr.-Ing. Achim Dittler

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

**Part of:** M-CIWVT-101141 - Particle Technology

<table>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗝 On-Site, ✗ Cancelled

**Prerequisites**

None
# 5.77 Course: Particle Technology [T-CIWVT-103655]

**Responsible:** Prof. Dr.-Ing. Achim Dittler  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** M-CIWVT-101141 - Particle Technology

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

**Prerequisites**

None
### 5.78 Course: Particle Technology Exam [T-CIWVT-106028]

**Responsible:** Prof. Dr.-Ing. Achim Dittler  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** M-CIWVT-101992 - Single Results

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Legend: 🖥 Online, ☑️ Blended (On-Site/Online), 🗣️ On-Site, ✗ Cancelled
5.79 Course: Physical Chemistry (Lab) [T-CHEMBIO-109179]

**Responsible:** PD Dr. Detlef Nattland

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

**Part of:** M-CIWVT-101992 - Single Results

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<td>2 SWS Lecture</td>
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<td>2 SWS Practical course</td>
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**Competence Certificate**

The examination consists of two Parts:

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

**Prerequisites**

None
5.80 Course: Physical Chemistry (Written Exam) [T-CHEMBIO-109178]

**Responsible:** PD Dr. Detlef Nattland  
**Organisation:** KIT Department of Chemistry and Biosciences  
**Part of:** M-CIWVT-101992 - Single Results

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**Competence Certificate**

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

**Prerequisites**

Lab work has to be passed.
# 5.81 Course: Practical Course in Organic Chemistry for Chemical Engineers [T-CHEMBIO-101868]

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

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### Events

| WT 22/23 | 5123 | Organisch-Chemisches Praktikum für Studierende des Chemie- und Bioingenieurwesens | Practical course / 🗣 | Mitarbeiter, Rapp, Meier |

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

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The module M-CHEMBIO-101115 - Organic Chemistry for Engineers must have been passed.
5.82 Course: Practical Course Process Technology and Plant Design [T-CIWVT-106148]

**Responsible:** Prof. Dr.-Ing. Thomas Kolb

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

**Part of:** M-CIWVT-101992 – Single Results

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗺 On-Site, ✗ Cancelled

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-CIWVT-106149 - Initial Exam Process Technology and Plant Design must have been passed.
5 COURSES

Course: Process Development and Scale-up [T-CIWVT-103530]

5.83 Course: Process Development and Scale-up [T-CIWVT-103530]

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

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Modeled Conditions

The following conditions have to be fulfilled:

1. The course T-CIWVT-111005 - Exercises Process Development and Scale-up must have been passed.
5.84 Course: Process Development and Scale-up Project Work [T-CIWVT-103556]

**Responsible:** Prof. Dr.-Ing. Jörg Sauer

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

**Part of:** M-CIWVT-101153 - Process Development and Scale-up

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**Grading scale:** Grade to a third

**Recurrence:** Each summer term

**Version:** 1

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**Prerequisites**

none
## Course: Process Technology and Plant Design Written Exam [T-CIWVT-106150]

### Responsible:
Prof. Dr.-Ing. Thomas Kolb

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

### Part of:
M-CIWVT-101992 - Single Results

### Type
Written examination

### Credits
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### Grading scale
Grade to a third

### Recurrence
Each term

### Version
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5.86 Course: Rheology and Product Design [T-CIWVT-103522]

**Responsible:** Dr.-Ing. Claude Oelschlaeger

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

**Part of:** M-CIWVT-101144 - Rheology and Product Design

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**Prerequisites**

None

Legend: 🖥 Online, 📦 Blended (On-Site/Online), 👤 On-Site, ⚤ Cancelled
5.87 Course: Rheology and Product Design Project Work [T-CIWVT-103524]

**Responsible:** Dr.-Ing. Claude Oelschlaeger  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** M-CIWVT-101144 - Rheology and Product Design

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

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-CIWVT-103522 - Rheology and Product Design must have been passed.
5.88 Course: Safety Instruction [T-CIWVT-108293]

**Responsible:** Dr. Gudrun Abbt-Braun

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

**Part of:** M-CIWVT-101964 - Laboratory Work in General and Inorganic Chemistry

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**Prerequisites**

None
5.89 Course: Safety Instruction [T-CIWVT-108291]

**Responsible:** Dr. Sokratis Sinanis  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** M-CIWVT-101138 - Lab Work Process Engineering

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5.90 Course: Selected Formulation Technologies [T-CIWVT-106037]

**Responsible:** Prof. Dr.-Ing. Heike Karbstein

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

**Part of:** M-CIWVT-101992 - Single Results

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled
### 5.91 Course: Seminar Biotechnological Production [T-CIWVT-108492]

**Responsible:** Prof. Dr. Christoph Syldatk  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** M-CIWVT-101992 - Single Results

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled
5.92 Course: SmartMentoring - Group Management [T-CIWVT-111761]

**Responsible:** Dr.-Ing. Barbara Freudig

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

**Part of:** M-CIWVT-105848 - SmartMentoring

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5.93 Course: Thermal Process Engineering [T-CIWVT-101885]

**Responsible:** Prof. Dr.-Ing. Matthias Kind

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

**Part of:** M-CIWVT-101134 - Thermal Process Engineering

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Legend: 🖥 Online, 🟢 Blended (On-Site/Online), 🗒 On-Site, ✗ Cancelled
### Course: Thermal Transport Processes [T-CIWVT-106034]

**Responsible:**  
Prof. Dr.-Ing. Matthias Kind  
Prof. Dr.-Ing. Wilhelm Schabel  
Prof. Dr.-Ing. Thomas Wetzel

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

**Part of:**  
M-CIWVT-101992 - Single Results

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

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Chemical and Process Engineering Bachelor 2015 (Bachelor of Science (B.Sc.))
Module Handbook as of 28/09/2022
5.95 Course: Thermodynamics I, Exam [T-CIWVT-101879]

**Responsible:** Prof. Dr. Sabine Enders

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

**Part of:** M-CIWVT-101129 - Thermodynamics I

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**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-CIWVT-101878 - Thermodynamics I, Tutorial must have been passed.
5.96 Course: Thermodynamics I, Tutorial [T-CIWVT-101878]

**Responsible:** Prof. Dr. Sabine Enders

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

**Part of:** M-CIWVT-101129 - Thermodynamics I

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

**Prerequisites**

None
5.97 Course: Thermodynamics II, Exam [T-CIWVT-101881]

**Responsible:** Prof. Dr. Sabine Enders  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** M-CIWVT-101130 - Thermodynamics II

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

**Prerequisites**  
Precondition for participation: 2 of 3 compulsory exercises have to be approved

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

1. The course T-CIWVT-101880 - Thermodynamics II, Tutorial must have been passed.
5.98 Course: Thermodynamics II, Tutorial [T-CIWVT-101880]

Responsible: Prof. Dr. Sabine Enders
Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101130 - Thermodynamics II

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<td>Technische Thermodynamik II</td>
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<td>Tutorial / On-Site</td>
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Legend: 🖥 Online, 🌟 Blended (On-Site/Online), 🗂 On-Site, ✗ Cancelled

Prerequisites
None
### 5.99 Course: Thermodynamics III [T-CIWVT-106033]

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

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<th>Grading scale</th>
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Legend: 🖥 Online, ☰ Blended (On-Site/Online), 🔴 On-Site, 🗙 Cancelled
5.100 Course: Tutorial Advanced Mathematics I [T-MATH-100525]

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

**Organisation:** KIT Department of Mathematics

**Part of:**  
M-CIWVT-100874 - Orientation Exam  
M-MATH-100280 - Advanced Mathematics I

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**Events**

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**Competence Certificate**

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

**Prerequisites**

None.
5.101 Course: Tutorial Advanced Mathematics II [T-MATH-100526]

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

**Organisation:** KIT Department of Mathematics

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

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**Competence Certificate**

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

**Prerequisites**

None.
### 5.102 Course: Tutorial Advanced Mathematics III [T-MATH-100527]

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

**Organisation:** KIT Department of Mathematics

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

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**Events**

| WT 22/23 | 0131500 | Übungen zu 0131400 | 2 SWS | Practice | Hettlich |

**Competence Certificate**
Learning assessment is carried out by written assignments (pre-requisite). Exact requirements will be communicated in the lectures.

**Prerequisites**
None.
5.103 Course: Water Quality and Process Engineering of Water and Waste Water Treatment [T-CIWVT-103651]

**Responsible:** Dr. Andrea Hille-Reichel
Prof. Dr. Harald Horn

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

**Part of:** M-CIWVT-101152 - Water Quality and Process Engineering of Water and Waste Water Treatment

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

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

**Competence Certificate**
Project thesis: individual grades of the written report and the oral presentation.
(According to § 4 Abs. 2 Nr. 3 SPO Bachelor Bioengineering 2015)

**Prerequisites**
None
5.04 Course: Water Quality and Process Engineering of Water and Waste Water Treatment [T-CIWVT-103650]

**Responsible:** Dr. Gudrun Abbt-Braun  
Prof. Dr. Harald Horn  

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

**Part of:** M-CIWVT-101152 - Water Quality and Process Engineering of Water and Waste Water Treatment

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<td>Horn, Abbt-Braun</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, ✗ Cancelled

**Competence Certificate**

Success control is an overall oral examination of about 30 min according to § 4 Abs. 2 der SPO Bachelor Bioingenieurwesen 2015 of the lectures “22603 Scientific Principles for Water Quality Assessment" and "22607 Water Quality and Process Engineering of Water and Waste Water Treatment".

**Prerequisites**

None
### 5.105 Course: Wildcard Additional Examinations 1 [T-CIWVT-103768]

**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** M-CIWVT-102011 - Further Examinations

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**Prerequisites**
none
5.106 Course: Wildcard Additional Examinations 11 [T-CIWVT-103790]

Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-102011 - Further Examinations

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Course: Wildcard Master's Transfer Account 11 [T-CIWVT-104047]

Organisation: KIT Department of Chemical and Process Engineering
Part of: M-CIWVT-101992 - Single Results

Type: Examination of another type
Credits: 2
Grading scale: Grade to a third
Version: 1