OTTO-VON-GUERICKE-UNIVERSITÄT MAGDEBURG

Fakultät für Maschinenbau
Fakultät für Verfahrens- und Systemtechnik
Fakultät für Elektrotechnik und Informationstechnik

Modulhandbuch
für den Bachelorstudiengang
Engineering Science

Module Handbook
for the Bachelors Program
Engineering Science

B-EngSci

zur studiengangspezifischen
Studien- und Prüfungsordnung vom
25. März 2024
amtl. Bekanntmachung Nr. 41/2024

to the course-specific
Study and examination regulations from
25. March 2024
official announcement Nr. 41/2024

Version: 01.04.2025

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1 Kurzbeschreibung des Studiengangs | Description of the study program

Name des Studiengangs:	Engineering Science	Name of the Study program:	Engineering Science
Art des Studiengangs:	Präsenzstudiengang (Vollzeitstudium)	Type of Course of studies:	Attendance course of studies (full-time study)
Abschluss:	Bachelor of Science (B. Sc.)	Degree:	Bachelor of Science (B. Sc.)
Umfang:	6 Semester	Duration:	6 semesters
Profil:	„grundlagenorientiert“	Profile:	„fundamentally oriented“

Ausbildungsergebnisse
(Fachliche Kompetenzen)**:**

Der Bachelorstudiengang „Engineering Science“ ist grundlagen- und methodenorientiert. Der Studiengang führt die Studierenden an das facettenreiche Spektrum und die Vielfältigkeit des Ingenieurberufs heran und adressiert dabei die Schwerpunktthemen: Maschinenbau, Verfahrenstechnik und Elektrotechnik.

Studierende sollen qualifiziert werden, über das vermittelte breite Grundlagenangebot die unterschiedlichen Ingenieurdisziplinen zu verstehen und zu verknüpfen und mit den im Studium erworbenen Kenntnisse und Fähigkeiten theoretische sowie anwendungsbezogene Problemstellungen selbstständig, lösungsorientiert sowie interdisziplinär zu bearbeiten, um für gegenwärtige und zukünftige Herausforderungen neue kreative Lösungen zu entwickeln und schnittstellenübergreifende Synergien zu erschließen. Sie erlangen die Fähigkeiten, Meinungen kritisch zu hinterfragen, Probleme zu identifizieren und wissenschaftlich strukturiert unter Berücksichtigung angrenzender Fachdisziplinen zu lösen und ihre erarbeitete Lösung zu vertreten. Sie sind in der Lage, sich selbst neues Wissen anzueignen und sowie sensibilisiert für ein technisch orientiertes, verantwortungsbewusstes Arbeiten.

Abhängig vom eigenen Interesse können individuelle Ziele definiert und durch die Wahl von entsprechenden Modulen eine der drei Profilierungsrichtungen angestrebt werden:

- Mechanical Engineering (Maschinenbau)
- Process and Systems Engineering (Verfahrens- und Systemtechnik)
- Electrical Engineering and Information Technology (Elektro- und Informationstechnik)

Das abgeschlossene Bachelorstudium qualifiziert die Absolventen für seinen Einsatz im Beruf.

Die beruflichen Einsatzmöglichkeiten und Tätigkeitsfelder von Absolventinnen und Absolventen sind sehr vielfältig. Sie umfassen je nach gewählter Profilierungsrichtung die Branchen des Maschinen- und Anlagenbaus, der Verfahrens- und Prozesstechnik oder der Elektro- und Informationstechnik, mit den Aufgaben Entwicklung, Berechnung, Planung und Fertigung sowie der Zustandserfassung

Educational Results
(Professional competences):

The Bachelor's degree course in Engineering Science is fundamentally and methodologically oriented. The course introduces students to the multifaceted spectrum and diversity of the engineering profession and addresses the key topics: Mechanical engineering, process engineering and electrical engineering.

Students should be qualified to understand and interconnect the various engineering disciplines through the broad range of fundamental subjects provided, and to independently address theoretical and application-related issues in a solution-oriented and interdisciplinary manner with the knowledge and skills acquired during their studies. This approach aims to develop new creative solutions for current and future challenges and to unlock cross-disciplinary synergies. Students gain the ability to critically question opinions, identify problems, and solve them in a scientifically structured manner, taking into account adjacent disciplines, and to defend their solutions. They are capable of acquiring new knowledge on their own and are sensitized to a technically oriented, responsible work.

Depending on their own interests, students can define individual goals and choose one of the three profile directions by selecting the appropriate modules:

- Mechanical Engineering (Maschinenbau)
- Process and Systems Engineering (Verfahrens- und Systemtechnik)
- Electrical Engineering and Information Technology (Elektro- und Informationstechnik)

The Bachelor's degree qualifies graduates for employment.

The career opportunities and fields of activity for graduates are very diverse. Depending on the chosen specialization, they cover the industry branches of mechanical and plant engineering, process engineering or electrical engineering and information technology, with the tasks including development, calculation, planning and production as well as condition

und Instandhaltung von entsprechenden Produkten und Anlagen.

Absolventinnen und Absolventen werden in allen klassischen und innovativen Industriebranchen gebraucht. Sehr gute Beschäftigungsaussichten bieten sich in allen Bereichen des Maschinen-, Anlagen-, des Automobil- und Fahrzeugbaus, in der chemischen und pharmazeutischen Industrie, der Futter-, Nahrungs- und Genussmittelindustrie, Werkstofftechnik, Gebäudetechnik, Wärme- und Kältetechnik, Medizintechnik, in allen Bereichen der Elektrotechnik, der Energietechnik und Elektronik sowie in IT- und Telekommunikationszweigen.

Die akademische Ausbildung mit dem Abschluss B.Sc. der Otto-von-Guericke-Universität (OVGU) liefert eine hinreichende Voraussetzung für weitere Ausbildungen im Bereich der Ingenieurwissenschaften und angrenzender Gebiete.

Er versetzt die Absolventen und Absolventinnen in die Lage, mit Erfolg einen zweiten berufs- und forschungsqualifizierenden Abschluss „Master of Science (M.Sc.)“ in den Master-Studiengänge der drei Ingenieurfakultäten der OVGU zu erlangen.

monitoring and maintenance of corresponding products and systems.

Graduates are needed in all traditional and innovative branches of industry. Excellent employment prospects are available in all areas of mechanical engineering, plant engineering, automotive and vehicle construction, the chemical and pharmaceutical industries, the feed, food, and luxury food industries, materials engineering, building technology, heating and cooling technology, medical technology, in all areas of electrical engineering, energy technology and electronics, as well as in IT and telecommunications branches.

The B.Sc. degree from Otto von Guericke University (OVGU) provides a sufficient basis for further training in the field of engineering and related areas.

It enables graduates to successfully obtain a second professional and research-qualifying degree "Master of Science (M.Sc.)" in the Master's degree programs of the three engineering faculties of the OVGU.

Ausbildungsergebnisse
(Soziale Kompetenzen):

Die Absolventen und Absolventinnen erlangen während des Studiums die sozialen Kompetenzen, die sie befähigen:

- über Inhalte und Probleme des Ingenieurwesens und angrenzender Disziplinen mit Fachleuten zu kommunizieren,
- Projekte durchzuführen,
- einzeln und integriert als Mitglied internationaler Gruppen zu arbeiten,
- Führungsverantwortung zu übernehmen sowie
- engagiert, zielorientiert, aufgabenbezogen und lernbereit in verschiedenen Berufsfeldern zu agieren.

Durch einen ausreichenden Praxisbezug sind sie auf das Berufsleben vorbereitet und sich in ihrem Handeln der gesellschaftlichen und ethischen Verantwortung bewusst.

Educational Results
(Social competences):

During their studies, graduates acquire the social skills that enable them to

- communicate with specialists about the content and problems of engineering and related disciplines,
- carry out projects,
- work individually and as an integrated member of international groups,
- assume leadership responsibility and
- act committedly, goal-oriented, task-related, and ready to learn in various professional fields.

With sufficient practical relevance, they are prepared for professional life and are aware of their social and ethical responsibility in their actions.

Kurzcharakteristik

Die Immatrikulation erfolgt zum Wintersemester. Die Unterrichtssprache ist Englisch. Nach freier Wahl können deutschsprachige Module belegt werden.

Der Studienaufwand wird mit Leistungspunkten (Creditpoints [CP]) beschrieben. Er beträgt insgesamt 180 CP, die sich auf den Pflicht- und Profilierungsbereich sowie die Bachelorarbeit verteilen. Das Arbeitspensum beträgt ca. 30 CP pro Semester.

Brief Description

Enrollment takes place in the winter semester. The language of instruction is English. Students may choose to take modules in German if they wish.

The study effort is described with credit points (CP). It amounts to a total of 180 CP, which are divided between the compulsory and professional areas and the Bachelor's thesis.
The workload is approx. 30 CP per semester.

In den ersten drei Semestern werden im Wesentlichen die Grundlagen der Natur- und Ingenieurwissenschaften vermittelt sowie eine entsprechende Sprachkompetenz erreicht. Internationalen Studierenden wird hierbei die Festigung und Qualifizierung der deutschen Sprache ermöglicht, ebenso wie nationalen Studierenden die Sprachqualifizierung in Englisch oder einer anderen Sprache.

In the first three semesters, students essentially learn the basics of natural sciences and engineering and acquire appropriate language skills. International students are given the opportunity to consolidate and qualify their German language skills and national students are given the opportunity to qualify their language skills in English or another language.

Begleitend zu den Grundlagenmodulen der drei Ingenieurdomänen Maschinenbau, Verfahrenstechnik und Elektrotechnik nimmt der Anteil der fachspezifischen Module ab dem 3. Semester kontinuierlich zu. Über die Projektarbeit und die vorgelagerte Vermittlung von Kenntnissen zum wissenschaftlichen Arbeiten erlangen die Studierenden erste Fähigkeiten des Projektmanagements sowie Kompetenzen, die es ermöglichen, Teamarbeit zu organisieren sowie Projektergebnisse zu dokumentieren und vor einem Fachgremium zu vertreten.

Alongside the fundamental modules of the three engineering domains—mechanical engineering, process engineering, and electrical engineering—the proportion of domain-specific modules begins to increase continuously from the third semester. Through project work and the preliminary impartation of knowledge on scientific working methods, students acquire initial project management skills and competencies that enable them to organize teamwork, document project results, and present them before an expert panel.

Um den Studierenden zu jedem Zeitpunkt eine Verfolgung der eigenen Interessen und Neigungen zu ermöglichen, erfolgt keine verpflichtende Einschreibung in eine Profilierungsrichtung. Die Profilierungsrichtung ergibt sich durch den erfolgreichen Abschluss von 4 Modulen mit mindestens 20 CP aus einem der Profilierungsbereiche.

In order to allow students to pursue their own interests and inclinations at any time, there is no compulsory enrolment in a specialization area. The specialization direction results from the successful completion of 4 modules with at least 20 CP from one of the specialization areas.

Im offenen Wahlpflichtbereich sind 15 CP zu erbringen. Über den offenen Wahlpflichtbereich kann ein Studium im gleichen oder in anderen Profilierungs- oder Wissenschaftsbereichen, an anderen – auch ausländischen – Universitäten sowie in industrienahen anwendungsbezogenen Themenfeldern erfolgen.

In the open elective area, 15 CP must be achieved. Through the open elective area, students can pursue studies in the same or different specialization areas or scientific fields, at other universities—including those abroad—as well as in industry-related, application-oriented topics.

Zum Abschluss des Studiums soll die Bachelorarbeit zeigen, dass die Studierenden in der Lage sind, innerhalb einer vorgegebenen Bearbeitungszeit eine Problemstellung selbständig, wissenschaftlich und kompetent zu bearbeiten.

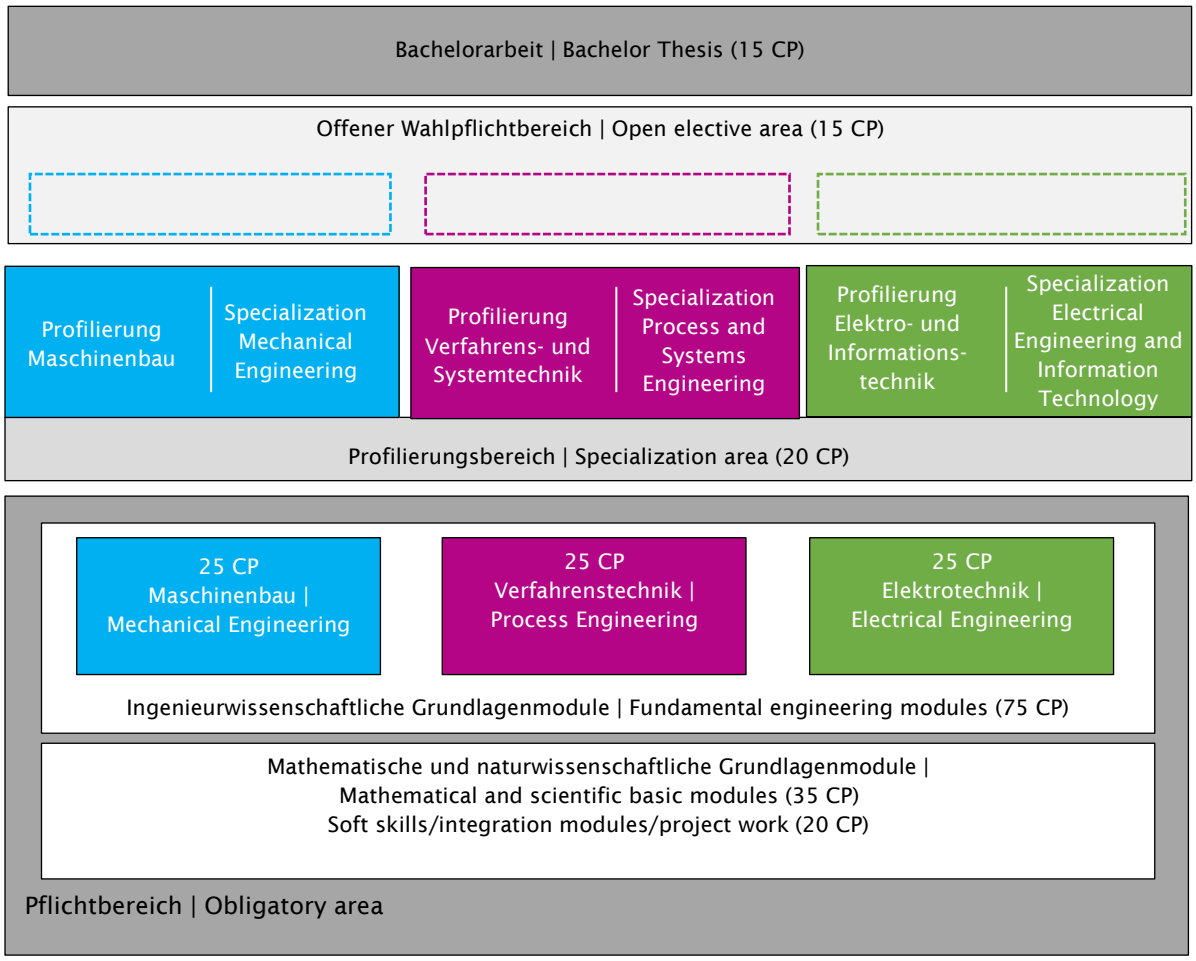
At the end of the course, the Bachelor's thesis should show that students are able to work on a problem independently, scientifically and competently within a given period of time.

Der Bachelorstudiengang ist so konzipiert, dass das Studium einschließlich der Anfertigung der Bachelorarbeit und deren Präsentation in einem Kolloquium in der Regelstudienzeit von sechs Semestern abgeschlossen werden kann.

The Bachelor's degree course is designed in such a way that the course, including the preparation of the Bachelor's thesis and its presentation in a colloquium, can be completed in the standard period of study of six semesters.

Die allgemeine Struktur des Studiengangs kann der Abbildung auf der nächsten Seite entnommen. Der Regelstudienplan inkl. der Definition der Pflichtmodule ist auf der übernächsten Seite dargestellt.

The general structur of the study program is shown on the figure at the next page. The general study plan including the obligatory modules is depicted on the page following that.



Prinzipieller Aufbau des Bachelorprogramms Engineering Science |
General structure of the bachelor degree program Engineering Science

Legende Prüfungsformen für Regelstudienplan auf der nächsten Seite:

K – Klausur (angegebene Dauer in Minuten)
R – Referat
S – Seminar- / Hausarbeit
W – Wissenschaftliches Projekt
R – Referat
B - Belegarbeit
V|Ü|P – Vorlesung | Übung | Praktikum in SWS
SWS – Semesterwochenstunde
PL* - Prüfungsleistung entsprechend Modul

Gemäß §14 (11) der Allgemeinen Studien- und Prüfungsordnung können für jedes Modul vom Modulverantwortlichen Prüfungsvorleistungen festgelegt werden, die als Voraussetzungen für den Erhalt von CP erforderlich sind.

Legend forms of examination on the next page:

K – written exam (duration in minutes),
R – oral presentation,
S – homework, term paper
W – scientific project
R – oral presentation,
B - coursework
V|Ü|P – Lecture | Exercise | Practical course in SWS
SWS - Semester hour per week
PL* - Examination performance according to module

In accordance with §14 (11) of the General Study and Examination Regulations, the module supervisor may specify preliminary examination requirements for each module, which are necessary as prerequisites for obtaining CP.

Regelstudienplan allgemein | General study plan

Bachelor Engineering Science Moduls	CP	V|Ü|P [SWS]	Semester 1. PL	2. PL	3. PL	4. PL	5. PL	6. PL	Σ
Mathematics and Computer science									**25**
Mathematics 1E	5	3|3|0	K75						5
Mathematics 2E	5	3|3|0		K75					5
Mathematics 3E	5	3|3|0			K75				5
Mathematics 4E	5	3|3|0				K75			5
Introduction to Computer Science for Engineers	5	3|2|0	K120						5
Scientific basic modules									**10**
Physics	10	2|2|0	K90						10
		2|2|0		K90					
Fundamental engineering modules									**75**
Materials I	5	2|1|1	K90						5
Engineering Design Graphics	5	2|2|0	K120+ K90						5
Fundamentals of Machine Elements	5	2|2|0				K120			5
Engineering Mechanics 1	5	2|3|0		K120					5
Engineering Mechanics 2/3	5	2|3|0			K120				5
Electrical engineering I	5	2|2|0	K120						5
Electrical engineering II	5	2|1|1		K90					5
Introduction to control engineering	5	2|2|0					K90		5
Measurement methods	5	2|2|0			K90				5
Introduction to systems theory	5	2|2|0				K90			5
Thermodynamics	5	2|2|0				K90			5
Fluid dynamics	5	2|2|0					K120		5
Chemistry	5	2|2|0	K120						5
Fundamentals of Sustainable Process Engineering	10	2|2|0			K180				10
Soft skills/integration modules/project work									**20**
Scientific work & Project work	10					~	W		10
Language certificate in German or other language	10			~	Unicert				10
Mandatory elective area | Wahlpflichbereich									**35**
Specialization area | Profilierungsbereich									20
Specialisation MB: Mechanical Engineering									
					PL*	PL*	PL*	PL*	20
Specialisation VST: Process and Systems Engineering									
					PL*	PL*	PL*	PL*	20
Specialization EIT: Electrical Engineering and Information Technology									
					PL*	PL*	PL*	PL*	20
Open elective area | offener Wahlpflichbereich									15
Modul 1						PL*			
Modul 2							PL*		
Modul 3								PL*	
Bachelor thesis | Bachelorarbeit									15
Bachelor thesis with colloquium, Seminar								W	15
Total CP | Summe CP : B-EngSci-MB			30	30	35	30	30	25	180
Total CP | Summe CP : B-EngSci VST			30	30	35	30	30	25	180
Total CP | Summe CP : B-EngSci EIT			30	30	35	30	30	25	180

2 Geltung des Modulhandbuchs | Validity of the module handbook

Das vorliegende Modulhandbuch gilt für Studierende, deren Studium sich nach der studiengangspezifischen Studien- und Prüfungsordnung für den Bachelorstudiengang Engineering Science vom 2024 (Datum der Fakultätsratsbeschlusses) richtet.

This module handbook applies to students whose studies are based on the course-specific study and examination regulations for the Bachelor's degree program in Engineering Science dated 2024 (date of the Faculty Council resolution).

3 Pflichtbereich | Obligatory area

Die Module des Pflichtbereichs vermitteln in den ersten drei Semestern die Grundlagen der Natur- und Ingenieurwissenschaften sowie eine entsprechende Sprachkompetenz Deutsch oder anderweitig. Internationalen Studierenden wird die Festigung und Qualifizierung der deutschen Sprache ermöglicht und explizit ermutigt werden, nach dem Abschluss des Studiums auch den regionalen bzw. nationalen Arbeitsmarkt in Betracht zu ziehen.

Für deutsche Muttersprachler empfiehlt sich hier eine mögliche Sprachausbildung in Englisch hin zu C1-Niveau bzw. den Erwerb anderweitiger Sprachkompetenzen. Weitere Alternativen können beim Prüfungsausschuss über einen formlosen Antrag beantragt werden.

In the first three semesters, the compulsory modules teach the basics of natural sciences and engineering as well as the corresponding language skills in German or another language. International students are given the opportunity to consolidate and qualify their German language skills and are explicitly encouraged to consider the regional or national job market after graduation.

For German native speakers, a possible language training in English up to C1 level or the acquisition of other language skills is recommended. Further alternatives can be requested from the Examination Board via an informal application.

4 Wahlpflichtbereiche | Mandatory elective area

4.1 Allgemeines | General information

Die im Bachelorzeugnis bescheinigte Profilierungsrichtung ergibt sich durch den erfolgreichen Abschluss von Modulen im Umfang von 20 CP aus dem jeweiligen Modulangebot der Profilierungsrichtung.

Die möglichen Profilierungsrichtungen im Bachelorstudiengang Engineering Science sind:

» Mechanical Engineering (Maschinenbau)

» Process and Systems Engineering (Verfahrens- und Systemtechnik)

» Electrical Engineering and Information Technology (Elektro- und Informationstechnik)

The specialization area certified in the Bachelor's certificate results from the successful completion of modules amounting to 20 CP from the respective module offer of the specialization area.

The possible specializations in the Bachelor's degree course in Engineering Science are

» Mechanical Engineering

» Process and Systems Engineering

» Electrical Engineering and Information Technology

4.2 Offener Wahlpflichtbereich | Open elective area

Im offenen Wahlpflichtbereich sind insgesamt 15 CP zu erbringen.

Dabei steht es den Studierenden offen, sich weiter in der favorisierten Profilierung zu vertiefen, indem die noch nicht belegten Module belegt werden. Ebenso bietet sich darüber die Möglichkeit, sich für Module anderer Profilierungsbereiche oder aus anderen Wissenschaftsgebieten der OVGU zu interessieren, ebenso sind Module anderer europäischer Hochschulen (z. B. im EU-Green Verbund) wählbar.

Um betriebs-technische Erfahrungen in Aufgabenfeldern und Tätigkeitsbereichen von Ingenieuren und Ingenieurinnen zu sammeln, werden die Studierenden insbesondere ermutigt, ihre eigenen praktischen Kenntnisse durch Integration eines Industrieprojektes zu erwerben.

Bei der Wahl der Module im offenen Wahlpflichtbereich sollte sich das eventuell anschließende Masterstudium nicht außer Acht gelassen werden. Über den offenen Wahlpflichtbereich können mögliche spezifische Zulassungsvoraussetzungen des angestrebten Masterstudiengangs erreicht werden.

Unter den jeweiligen Textabschnitten zu den Profilierungsrichtungen werden dazu exemplarische Hinweise gegeben.

A total of 15 CP must be earned in the open elective area.

Students are free to deepen their knowledge of their preferred specialization by taking modules they have not yet completed. It is also possible to take modules from other specialization areas or from other scientific fields at OVGU, as well as modules from other European universities (e.g. in the EU-Green network).

Students are particularly encouraged to acquire their own practical knowledge by integrating an industrial project in order to gain experience in the tasks and fields of activity of engineers.

When selecting modules in the open elective area, students should consider the requirements for any Master's program they might wish to pursue afterward. The open elective section offers an opportunity to fulfill specific entry prerequisites of the targeted Master's degree program.

Exemplary information on this is provided in the respective sections of the text about the specializations.

4.3 Wahlpflichtbereich PROFILIERUNG | Mandatory elective area SPECIALIZATION

4.3.1 Profilierung Maschinenbau | Specialization Mechanical Engineering

Ein Studium der Profilierung Maschinenbau versetzt die Absolventinnen und Absolventen in die Lage, in allen klassischen und innovativen Industriebranchen vor allen in den Bereichen des Maschinen- und Anlagenbaus, des Automobil- und Fahrzeugbaus, der Energie- und Luftfahrttechnik, aber auch in angrenzenden Gebieten, z. B. der Medizintechnik tätig zu werden. Typische Einsatzfelder sind beispielsweise Berechnung (Auslegung), Simulation, Konstruktion und Entwicklung, Versuch und Test, Produktion, Qualitätssicherung, Wartung und Instandhaltung sowie Recycling.

A degree with the specialization Mechanical Engineering enables graduates to work in all traditional and innovative industrial sectors, especially in the fields of mechanical and plant engineering, automotive and vehicle construction, energy and aviation technology, but also in related fields such as medical technology. Typical fields of application include design, simulation, development, experimentation and testing, production, quality assurance, maintenance and repair as well as recycling.

Mit den gewählten Modulen sind die Studierenden in der Lage, einen zweiten berufs- und forschungsqualifizierenden Abschluss „Master of Science (M.Sc.)“ in allen Master-Studiengängen der Fakultät für Maschinenbau der OVGU zu erlangen. Jedoch müssen die spezifischen Zulassungsvoraussetzungen der verschiedenen Masterstudiengänge beachtet (s. Abschnitt 4.3.4).

With the selected modules, students are able to obtain a second professional and research-qualifying degree, "Master of Science (M.Sc.)," in all Master's programs offered by the Faculty of Mechanical Engineering at OVGU. However, the specific admission requirements of the various Master's programs must be taken into account (see section 4.3.4).

Für ein weiterführendes Studium im Masterstudiengang Systems Engineering (M-SEM) sind beispielsweise wirtschaftswissenschaftliche Kompetenzen erforderlich. Diesem Erfordernis kann durch eine entsprechende Wahl der Module im freien Wahlpflichtbereich entsprochen werden.

For example, economics skills are required for further studies in the Master's degree program in Systems Engineering (M-SEM). This requirement can be met by choosing the appropriate modules in the free elective area.

Für deutsch-sprachige Masterstudiengänge ist oftmals der Sprachnachweis Deutsch C1 Zulassungsvoraussetzung.

For German-language Master's programs, proof of German language proficiency at the C1 level is often a prerequisite for admission.

	CP	V|Ü|P [SWS]	Semester 1. PL	2. PL	3. PL	4. PL	5. PL	6. PL	Σ
Moduls of Specialization MB: Mechanical Engineering									20
CAx Basics	5	2|2|0				K120 +K90			
Fundamentals of manufacturing processes	5	2|2|0			K90				
Materials II	5	2|1|1				K90			
Numerical methods for simulation	5	2|2|0					K90		
Recommended Modules for the open elective area: for deepening in Mechanical Engineering									
Industrial project 1	5							W	
Industrial project 2	5							W	

4.3.2 Profilierung Verfahrens- und Systemtechnik | Specialization Process and Systems Engineering

Das Studium der Profilierung Verfahrens- und Systemtechnik bereitet die Studierenden darauf vor, basierend auf solidem Grundlagenwissen und detailliertem Verständnis der physikalischen, chemischen und biochemischen Grundvorgänge, alle ein Verfahren (System) ausmachenden Elemente (Prozesse, Teilprozesse, Mikroprozesse, elementare Grundvorgänge) und deren Zusammenwirken in einer ganzheitlichen Analyse zu betrachtet. In die Problemlösung und Synthese werden methodische Konzepte aus der Systemtechnik und Signalverarbeitung einbezogen. Weiterhin steht zunehmend die Nachhaltigkeit der zu betrachtenden Prozesse im Fokus.

Als Berufsfelder werden z. B. gesehen: Chemie, Pharmazie, Futter-, Nahrungs- und Genussmittelindustrie, Energietechnik, Umwelttechnik, Anlagenbau, Keramik, Metallurgie, Biotechnik, Baustoffe, Kältetechnik, Papier- und Textilindustrie.

Mit den gewählten Modulen sind die Studierenden in der Lage, einen zweiten berufs- und forschungsqualifizierenden Abschluss „Master of Science (M.Sc.)“ in den Master-Studiengängen der Fakultät für Verfahrens- und Systemtechnik der OVGU Chemical and Energy Engineering (CEE), Process, Safety and Environmental Engineering (PSEE), Nachhaltige Energiesysteme (NES), Nachhaltige Verfahrens- und Umwelttechnik (VTU) und Wirtschaftsingenieur für Verfahrens- und Systemtechnik zu erlangen.

Für deutsch-sprachige Masterstudiengänge ist oftmals der Sprachnachweis Deutsch C1 Zulassungsvoraussetzung.

The specialization Process and Systems Engineering is based on fundamental knowledge and detailed understanding of physical, chemical and biochemical principles and processes.

Students learn to analyse systems and processes on different levels of complexity and recognize interrelations thereof. They are able to identify problems and to develop strategies to solve challenges by using concepts and methods of systems engineering, including general aspects of sustainability, as one of the major principles.

The degree in this specialization enables graduates to work in vocational field like chemistry, pharmacy, food industry, energy supply, environmental and plant engineering, metallurgy, bio technology, refrigeration engineering, paper and textile industry and related fields.

With the selected modules, students are able to obtain a second professional and research-qualifying degree, "Master of Science (M.Sc.)," in the Master's programs offered by the Faculty of Process and Systems Engineering at OVGU. However, the specific admission requirements of the various Master's programs must be taken into account (see section 4.3.4).

	CP	V|Ü|P [SWS]	Semester 1. PL	2. PL	3. PL	4. PL	5. PL	6. PL	Σ
Moduls of Specialization VST: Process and Systems Engineering									20
Modelling and Simulation of Process Systems	5	2|1|0				K60			
Biochemical Engineering	5	2|2|0			K90				
Product Quality in the Chemical Industry	5	2|1|0				K90			
Preparation Principles of Porous Materials	5	2|1|0						K90	
Python for Engineers	5	2|2|0				K180			
Sustainable Chemical Process Technology	5	2|1|0				K90			
Technical Risks	5						K120		

4.3.3 Profilierung Elektro- und Informationstechnik | Electrical Engineering and Information Technology

In dieser Profilrichtung werden grundlegende Fachkenntnisse der Elektrotechnik und Informationstechnik anwendungsbezogen vermittelt. Es werden aufbauend auf dem Pflichtbereich weitere elektro- und informationstechnische Grundlagen sowie Spezialkenntnisse vertieft. Das Lehrangebot richtet sich dabei nach den Anforderungen der modernen Industrie und befähigt die Studieren-den, nach wissenschaftlichen Methoden selbst-ständig und kreativ zu arbeiten. Zudem besteht die Möglichkeit, eigene fachliche Schwerpunkte nach persönlichen Interessen und Neigungen zu setzen.

Elektroingenieurinnen und -ingenieure arbeiten gegenwärtig in allen Industrie- und Dienstleistungsbereichen, in der klassischen Elektrotechnik, der Energietechnik und Elektronik sowie im Automobilbau, der Medizintechnik oder aber in IT- und Telekommunikationszweigen. Absolventinnen und Absolventen können dabei sowohl in der Forschung und Entwicklung als auch in der Produktion, dem Vertrieb und Management Aufgaben übernehmen. Darüber hinaus besteht die Möglichkeit als Selbstständige in folgenden Bereichen tätig zu werden: Elektrotechnik, elektrische Energiesysteme, Automatisierungstechnik / Robotik, Mess- und Sensortechnik, Informations- und Nachrichtentechnik, Medizinische Systeme, Kfz-Industrie, Verkehrstechnik, Maschinenbau, chemische Industrie, Umwelttechnik.

Mit den gewählten Modulen sind die Studierenden in der Lage, einen zweiten berufs- und forschungsqualifizierenden Abschluss „Master of Science (M.Sc.)“ in allen Master-Studiengängen der Fakultät für Elektrotechnik und Informationstechnik der OVGU zu erlangen. Jedoch müssen die spezifischen Zulassungsvoraussetzungen der verschiedenen Masterstudiengänge beachtet werden (s. Abschnitt 4.3.4).

Für ein weiterführendes Studium im Masterstudiengang Medical Systems Engineering (M-MSE) sind beispielsweise Kompetenzen im Bereich Anatomie / Physiologie erforderlich. Diese Erfordernisse können durch entsprechende Wahlmodule im Wahlpflichtbereich entsprochen werden.

Für den englischsprachigen Masterstudiengang Electrical Engineering and Information Technology (M-EEIT) sind keine zusätzlichen Kompetenzen erforderlich.

Für deutsch-sprachige Masterstudiengänge ist oftmals der Sprachnachweis Deutsch C1 Zulassungsvoraussetzung.

This specialization conveys fundamental, application-based specialist knowledge of electrical engineering and information technology. After studying the basics of engineering, specialist knowledge is consolidated. In the process, the courses focus on the requirements of modern industry and enable students to work independently and creatively in accordance with scientific methods. In addition, it is possible for students to define their own are-as of study emphasis according to their personal interests and inclinations.

Today electrical engineers work in every industrial and service sector, in traditional electrical engineering, energy engineering and electronics as well as in automotive engineering, medical technology and in the IT and telecommunications industries. Graduates of this course are able to take up roles in research & development as well as production, sales & marketing, and management. In addition, it is also possible for graduates to become self-employed in the following fields: electrical engineering, electrical energy systems, automation technology / robotics, measuring and sensor technology, information engineering and telecommunications, medical systems, the auto-motive industry, transport technology, mechanical engineering, the chemical industry and environ-mental engineering.

With the selected modules, students are able to obtain a second professional and research-qualifying degree, "Master of Science (M.Sc.)," in all Master's programs offered by the Faculty Electrical Engineering and Information Technology at OVGU. However, the specific admission requirements of the various Master's programs must be taken into account (see section 4.3.4).

For further studies in the Master's degree pro-gram in Medical Systems Engineering (M-MSE) for instance, skills in the area of anatomy / physiology are required. Given requirements can be met by choosing the appropriate modules in the free elective area.

For the English taught master program Electrical Engineering and Information Technology (M-EEIT) there are no additional skills required.

For German-language Master's programs, proof of German language proficiency at the C1 level is often a prerequisite for admission.

	CP	V|Ü|P [SWS]	Semester 1. PL	2. PL	3. PL	4. PL	5. PL	6. PL	Σ
Moduls of Specialization EIT: Electrical Engineering and Information Technology									20
Components and circuit technology	5	2|2|0			K60				
Communication technology	5	3|2|0					K120		
Computer engineering	5	2|2|0					K90		
Electric energy, power electronics and drives	5	2|2|0				K90			
Introduction to AI in engineering	5	2|1|0				K90			
Introduction to medical engineering	5	2|1|1					K90		
Microsystems	5	4|0|0				K90			

4.3.4 Modulwahlhinweise für die Anschlussfähigkeit zu den Masterprogramm der Ingenieurfakultäten | Module selection advice for compatibility with the Master's programs of the engineering faculties

Im Folgenden werden zur besseren Übersicht die notwendigen Voraussetzungen für die Masterstudiengänge der Ingenieurfakultäten aufgeführt, die nicht durch die Pflichtmodule des Studiengangs Engineering Science abgedeckt werden.

The following list provides an overview of the prerequisites for the Master's programs in the engineering faculties that are not covered by the compulsory modules of the Engineering Science program.

	CP	V|Ü|P [SWS]	Semester 1. PL	2. PL	3. PL	4. PL	5. PL	6. PL	Σ
Prerequisite for the FMB Master Degree SEM									
Economics modules from the Bachelor's degree programs offered by the FWW	10					PL*	PL*		
Fundamentals of Manufacturing Processes	5								
Prerequisite for the FMB Master Degrees BiME and CoME									
none									
Prerequisite for FVST Master Degrees CIW and BSYT									
Please contact the academic advisor of the study program									
Prerequisite for FVST Master Degrees NES and VTU									
None									
Prerequisite for the FEIT Master Degree EEIT									
None									
Prerequisite for the FEIT Master Degree MSE									
Please contact the academic advisor for Medical Systems Engineering									

5 Allgemeine Hinweise | General Notes

5.1 An- und Abmeldung von studienbegleitenden Prüfungsleistungen | Registration and deregistration for study program related exams

Fakultätsübergreifend vereinheitlichen die Allgemeinen Bestimmungen über die Änderung und Ergänzung der Studien- und Prüfungsordnungen an der Otto-von-Guericke-Universität Magdeburg betreffend Prüfungen (All-gSPO-2023) die

The General Provisions on the Amendment and Supplementation of the Study and Examination Regulations at Otto von Guericke University Magdeburg concerning Examinations (All-gSPO-2023) standardize the examination regulations across all faculties.

Anmeldung zu Modulprüfungen auf die Zeiträume

Registration for module examinations for the periods

15.11.-30.11. für Prüfungen im Wintersemester bzw.

15.11.-30.11. for examinations in the winter semester and

15.05.-31.05. für Prüfungen im Sommersemester.

15.05.-31.05. for examinations in the summer semester.

Für nachträglich geplante Prüfungen sowie Nachprüfungen innerhalb des gleichen Semesters legt das modulzuständige Prüfungsamt eine zweiwöchige Zulassungs-/Anmeldefrist für diese Prüfungen fest. Solche Prüfungen stehen allen Studierenden offen.

The Examination Office responsible for the module sets a two-week admission/registration period for examinations scheduled at a later date and re-examinations within the same semester. Such examinations are open to all students.

Widerruf: Die Anmeldung zur Prüfung kann bis spätestens 3 Kalendertage vor dem jeweiligen Prüfungstermin widerrufen werden. Im Falle des Widerrufs ist die Zulassung zu einem späteren Prüfungstermin erneut zu beantragen.

Revocation: Registration for the examination can be revoked up to 3 calendar days before the respective examination date at the latest. In the event of revocation, admission must be re-applied for at a later examination date.

Bei Krankheit ist ein ärztliches Attest (siehe Downloadbereich „Formulare“ unter fmb:intern) vorzulegen. Bei krankheitsbedingter Verhinderung des rechtzeitigen Einreichens des ärztlichen Attestes ist dem zuständigen Prüfungsamt dies entweder schriftlich oder in elektronischer Form per E-Mail bis zum Prüfungstag mitzuteilen. Das ärztliche Attest ist in diesem Fall innerhalb von drei Werktagen nach dem ärztlichen Feststellen des Krankheitsfalles beim zuständigen Prüfungsamt einzureichen. Über Ausnahmen entscheidet der zuständige Prüfungsausschuss.

In the event of illness, a medical certificate (see download area "Forms" under fmb:intern) must be submitted. If you are unable to submit the medical certificate on time due to illness, you must inform the relevant examination office either in writing or in electronic form by email by the day of the examination. In this case, the medical certificate must be submitted to the responsible examination office within three working days of the doctor's notification of the case of illness. The responsible examination board decides on exceptions.

6 Modulbeschreibungen

6.1 Biochemical Engineering

Course name	Biochemical Engineering	Exam number
German name	Bioverfahrenstechnik	
Teaching aims and content of the module	Learning objectives and competencies to be acquired: Students participating in this course are getting an in-depth view on activities in the field of biochemical engineering with an introduction into relevant topics of cell biology. They will learn basic principles regarding cultivation of microorganisms, upstream processing in bioreactors, and analysis of bioprocesses. In addition, they will know mathematical modeling approaches to describe growth and product formation in stirred tank bioreactors.	
	Contents • Introductory cell biology: Microorganisms, Chemistry of the living cell, Metabolism, Fundamentals of genetics • Bioprocess engineering principles: Cultivation of microorganisms, Upstream processing, Analysis of bioprocesses • Modeling of bioprocesses: Balance equations, Biochemical reactions, Growth and product formation, Selected examples from various fields of applications	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lecture	English
Literature	• H. Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D., Darnell, J. (4th ed. 2000) Molecular Cell Biology, W. H. Freeman and Company • Shuler, M.L., Kargi, F., DeLisa, M. (2017): Bioprocess Engineering: Basic Concepts, 3rd ed., Prentice Hall International Series • Stephanopoulos, G.N., Aristidou, A.A., Nielsen, J. (1998): Metabolic Engineering – Principles and methodologies. Academic Press, San Diego, London	
Preconditions for attending	Module: Fundamentals of Sustainable Process Engineering	
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination: written exam K90	
ECTS and marks	5 CP Oral examination	
Efforts	2+1 SWS (28 h lectures+14 h seminar/exercise + 62 h self-dependent studies)	
Frequency of provision	Every winter term	
Duration of module	One semester	
Responsible lecturer	NN	

6.2 CAx Basics

Course name	CAx Basics	Exam number
German title	CAx-Grundlagen	604299
Teaching aims and content of the module	Learning objectives and competencies to be acquired: • Basic knowledge of computer-aided tools and systems in product development • Knowledge of product models for developing and modelling products • Learning general procedures for 3D modelling • Competences to familiarise quickly with CAx systems • Knowledge of product development interfaces • Basic knowledge of storage and archiving of product data and documents • Acquiring of basic comprehensions of Product Lifecycle Management (PLM)	
	Contents: • Current situation in product development • Product development and computer assistance • Tools and systems of computer support • Components of a CAx system • CAx systems • Auxiliary functions in CAx • Product model definition • Types of product models • Procedures for 3D modelling • Archiving, interfaces, product data management • Product Lifecycle Management (PLM)	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lectures and CAx exercises accompanying lectures	English
Literature	See introduction lecture	
Preconditions for attending		
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination: written exam on the lecture content K120, CAD exam K90	
ECTS and marks	5 CP Marks according to Study and Examination Regulations	
Efforts	Attendance times: 2 SWS lecture, 2 SWS exercises Self-study: Preparation and wrap-up of lectures, literature studies, working on CAD exercises	
Frequency of provision	each summer semester	
Duration of module	one semester	
Responsible lecturer	Dr.-Ing. Dipl.-Math. Michael Schabacker, FMB	

6.3 Chemistry

Course name German title	Chemistry Chemie	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: • Students understand principles and structure of chemical elements and simple compositions thereof • They are able to understand and apply the (sometimes) complex and abstract relations in chemistry • Students know the most important types of chemical reactions and are able to formulate reaction equations • They can do stoichiometric calculations • Students know a selection of technically important (bulk)products and can describe the production and application thereof	
	Contents: 1. Atomic structure, quantum numbers, orbitals, periodic table of elements 2. Introduction into thermodynamics of chemical reactions, chemical equilibrium 3. Catalytical reaction: synthesis of ammonia and sulfur trioxide 4. solutions, electrolytes, solubility product, acid-base-theory, redox reactions 5. Hydrogen and selected elements of the main groups 6. Chemical bonds in organic compounds, nomenclature 7. Reaction behaviour and mechanisms on selected examples 8. Oxigen containig organic compounds: alkanols, ether, phenol and carbon acids and derivativs thereof 9. Introduction into stereochemistry, polymers, selected industrial processes	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lectures 2 SWS + Exercises 2 SWS for 1 semester	English
Literature	Lecture notes provided, Chemistry textbooks	
Preconditions for attending		
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination prerequsites:3 hand-ins Examination: written exam K120 with a pass grade	
ECTS and marks	5 CP Marks according to Study and Examination Regulations	
Efforts	Attendance: 56 hours, Self-study: 94 hours	
Frequency of provision	Every winter semester	
Duration of module	One semester	
Responsible lecturers	Prof. Dr. Franziska Scheffler, FVST	

6.4 Components and Circuit Technology

Course name German title	Components and Circuit Technology Bauelemente und Schaltungstechnik	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: Students acquire fundamental knowledge of semiconductor components and analog electronic circuits as well as the ability to classify the function of analog components based on their characteristic curves and component parameters. Students can furthermore analyze complex circuits by breaking them down into basic functional blocks and assess their functions. Students also understand the development methodology for designing basic semiconductor circuits and can dimension them.	
	Contents: • Semiconductor components: Diode, bipolar transistor, MOSFET • Basic transistor circuits: Operating points, large-signal, small signal behavior • Amplifiers: current sources, differential amplifiers, impedance converters • Operational amplifiers, internal structure, models, basic circuits, applications	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lecture and exercises	English
Literature	Tietze, U., Schenk, C., & Gamm, E. (2008). Electronic Circuits: Handbook for Design and Application (2nd ed.). Springer.	
Preconditions for attending	Recommended: Electrical Engineering I + II, Mathematics 1-2	
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination: written exam K60	
ECTS and marks	5 CP Marks according to Study and Examination Regulations	
Efforts	Attendance times: 2 SWS lecture, 2 SWS exercises Self-study: pre- and post-preparation of lectures, exercises and exam	
Frequency of provision	Every winter semester	
Duration of module	One semester	
Responsible lecturer	Prof. Dr.-Ing. Fabian Lurz, FEIT-IIKT	

6.5 Communication Technology

Course name German title	Communication Technology Kommunikationstechnik	Exam number
Teaching aims and content of the module	Learning objectives and Competencies to be Acquired: The aim of the lecture is to teach the basic principles of communications engineering. The focus is on signal transmission from the source to the sink, possible transmission methods and signal interference during transmission. In particular, students are familiar with the differences between analog and digital systems and are familiar with the equivalent consideration of communication systems in the time and frequency domain. At the end of the module, students will have gained an overview of a range of communication systems through the numerous examples and will have become familiar with their specific advantages and disadvantages. Students will be able to use what they have learned to specify the requirements of a communication system for a specific application and to specify the system.	
	Contents: • Wired and wireless transmission • Signal distortion and interference • Noise • Multiplexing and multi-user access methods • Frequency conversion (mixing) • Analog modulation methods (AM, FM, PM) • Sampling theory, quantization, coding, data compression • Digital modulation methods (PCM, ASK, PSK, FSK, QAM) Introduction to information theory	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lecture and exercises	English
Literature	See E-Learning platform	
Preconditions for attending	Recommended: Introduction to systems theory	
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination: written exam K120	
ECTS and marks	5 CP Marks according to Study and Examination Regulations	
Efforts	Attendance times: 3 SWS lecture, 2 SWS exercises Self-study: pre- and post-preparation of lectures, exercises, and exam	
Frequency of provision	Every winter term	
Duration of module	One semester	
Responsible lecturer	Prof. Dr. habil. Holger Maune, FEIT-IIKT	

6.6 Computer Engineering

Course name German title	Computer Engineering Technische Informatik	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: Students acquire a basic understanding of the structure and function of digital systems. They understand the structure of microcontrollers and can explain how the individual components of a microcontroller work. They are able to connect peripheral components to a microcontroller and program corresponding systems in C in a hardware-oriented manner. They can explain how different bus architectures work and control peripheral components via corresponding bus protocols. This enables students to recognize and evaluate problems in connection with the development of microcontroller-based systems and to find solutions. In the exercises, these skills are deepened using practical examples.	
	Contents: • Basic understanding of synchronous circuit design • Datapath and control logic of simple CPUs • Structure of microcontrollers (case study RISC-V) • Interfacing peripheral components • Interrupt controler • Hardware-oriented programming of microcontrollers in C • Basics of bus architectures • Synchronous and asynchronous bus protocols for connecting external peripheral components Programmable Logic	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lectures and exercises accompanying lectures	English
Literature	Sarah Harris, David Harris: Digital Design and Computer Architecture, RISC-V Edition, Morgan Kaufmann, 2021 Thomas L. Floyd: Digital Fundamentals, Pearson, 2015	
Preconditions for attending		
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination prerequisite: announcement at the beginning of the course Examination: written exam K90	
ECTS and marks	5 CP Marks according to Study and Examination Regulations	
Efforts	Attendance times: 2 SWS lecture, 2 SWS exercises Self-study: pre- and post-preparation of lectures, exercises and exam	
Frequency of provision	Every winter semester	
Duration of module	One semester	
Responsible lecturer	Prof. Thilo Pionteck, FEIT-IIKT	

6.7 Engineering Design Graphics

Course name German name	Engineering Design Graphics Technische Darstellungslehre	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: • Learning and developing skills and abilities for the technical presen-ta-tion of products and their documentation • Determining the function, structure and design of technical objects (components, assemblies, technical systems) • Acquiring basic knowledge of standard-compliant drafting creation in mechanical engineering • Acquiring basic knowledge of 3D CAD modelling (solid modelling, data exchange and data management, assembly and drafting creation)	
	Contents • Basics of the representation of technical structures • Basics of technical draftings: types of projections, representation of views, scales, line types and line thicknesses, production of hand draw-ings of components • Projection methods: process, relationships between points, straight lines and planes, true sizes, intersection and development of solids • Standardized representation of form elements on components (e.g. radii, chamfers, undercuts, centering holes, threads) and machine elements (e.g. rolling bearings, gears, sealing elements) • Basics of dimensioning and dimensioning rules • Shape deviations: dimensional, shape and position deviations, tolerance principle, surface deviations • Introduction to product documentation • Fundamentals of computer-integrated product development: 3D CAD systems, creation of individual parts and assemblies, data exchange and data management, derivation and completion of assembly draftings, and individual part draftings and bill of materials	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lecture and exercises accompanying the lecture, independent work on assignments	English
Literature		
Preconditions for attending		
Usability of module	According to module handbook Suitable as an Erasmus exchange module	
Prerequisites for the provi-sion of ECTS	Examination prerequisite: announcement at the beginning of the course Two-part examination: written exam K120 and 3D-CAD exam K90	
ECTS and marks	5 CP Grading following Study and Examination Regulations	
Efforts	Attendance times: 2 SWS lecture and 2 SWS tutorial Self-study: independent preparation and follow-up of lectures and exer-cises, preparation of supporting documents	
Frequency of provision	Every winter term	
Duration of module	One semester	
Responsible lecturer	Prof. Beyer; FMB Further lecturers: Dr Träger, Dr Schabacker; FMB	

6.8 Electric Energy, Power Electronics and Drives

Course name	Electric Energy, Power Electronics and Drives	Exam number
German title	Elektrische Energietechnik, Leistungselektronik und Antriebe	
Teaching aims and content of the module	Learning objectives and competencies to be acquired: The students understand the basics of electric energy systems, power electronics and electric drives, in particular their functional principle and mathematical description. Based on this they are able to autonomously solve elementary problems in these areas, considering their context within the discipline and interdisciplinarily, referring to system design and the consideration of existing systems by performing calculations and simulations and adequately evaluating their results.	
	Contents: • electric power systems: principles of most common assets, fundamental network calculation methods • major power electronic circuits for power supplies and drives • drive systems and usual electric machines	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lecture and exercises accompanying the lecture, independent work on assignments	English
Literature	See indications in the elearning system	
Preconditions for attending	Basic lectures in electrical engineering and mathematics	
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination: written exam K90	
ECTS and marks	5 CP Marks according to Study and Examination Regulations	
Efforts	Attendance times: 4 SWS seminar Self-study: pre- and post-preparation of the seminar and exam	
Frequency of provision	Every in the summer semester	
Duration of module	One semester	
Responsible lecturer	Prof. Lindemann, Prof. Wolter, Prof. Leidhold, FEIT-IESY	

6.9 Electrical Engineering I

Course name German name	Electrical Engineering I Allgemeine Elektrotechnik I	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: Through this module, students are enabled to understand and apply basic concepts of electrical engineering. They can recognize fundamental relationships. They are capable of performing simple calculations and elementary experiments in the laboratory.	
	Contents • Basic concepts • Passive circuits elements • Electric field, magnetic field • Circuit analysis resistive network • Alternating quantities • Three phase system • Transient behavior	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lectures, exercises	English
Literature	Salam, Rahman: Fundamentals of Electrical Circuit Analysis. (https://doi.org/10.1007/978-981-10-8624-3)	
Preconditions for attending		
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination prerequisite: Exercise certificate confirming successful preparation and participation of online tests Examination: written exam K120	
ECTS and marks	5 CP Grading following Study and Examination Regulations	
Efforts	Attendance times: 2 SWS lecture, 2 SWS exercises Self-study: pre- and post-preparation of lectures, exercises, seminars and exam	
Frequency of provision	Every winter term	
Duration of module	One semester	
Responsible lecturer	Prof. Vick, FEIT-IMT	

6.10 Electrical Engineering II

Course name German name	Electrical Engineering II Allgemeine Elektrotechnik II	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: This module enables students to understand the basic mode of operation and behavior of electrical machines, electronic devices and circuits. This will enable them to identify the main areas of application of electrical engineering. They are capable to perform basic calculations for the analysis of machines and circuits, and to carry out elementary experiments in the laboratory.	
	Contents • Electric machines • Fundamental of electronics • Analogue and digital circuits • Power converters • Measurement of electrical variables • Safety measures in electrical installations	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lectures, exercises and laboratory seminar	English
Literature		
Preconditions for attending	Electrical Engineering I For admission to the seminar, the exercise certificate for Electrical Engineering I, which confirms successful preparation and participation in the laboratory exercises, is required.	
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination prerequisite: Exercise certificate confirming successful preparation and participation in the laboratory exercises. Examination: written exam K90	
ECTS and marks	5 CP Grading following Study and Examination Regulations	
Efforts	Attendance times: 2 SWS lecture, 1 SWS exercises, 1 SWS seminar Self-study: pre- and post-preparation of lectures, exercises, seminars and exam	
Frequency of provision	Every summer term	
Duration of module	One semester	
Responsible lecturer	Prof. Leidhold, FEIT-IESY	

6.11 Engineering Mechanics 1

Course name German name	Engineering Mechanics 1 Technische Mechanik 1	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: • Students are familiar with the basic concepts and fundamental methods of Engineering Mechanics in the areas of Statics and Strength of Materials and can categorize them in terms of their validity. • When faced with problems in the field of Statics and the initial foundations of Strength of Materials, they are capable of utilizing the principles conveyed and the resulting methodological approach to identify solutions, analyze them, and make comparisons. Upon completion of this module, students have acquired systemic competence in modeling and calculating simple rigid systems under static conditions and have gained initial fundamental knowledge within the field of Strength of Materials.	
	Contents Fundamentals of Statics: • Planar and spatial force systems, shear forces in beam and truss structures, friction and adhesion, calculation of centroids. Fundamentals of Strength of Materials: • Assumptions, definitions for deformations and stresses, Hooke's Law, basics of loading states.	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lectures, exercises, independent work	English
Literature		
Preconditions for attending	Recommended: Mathematics 1	
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Preparatory assessment: admission test, laboratory tutorial Examination: written exam K120	
ECTS and marks	5 CP Grading following Study and Examination Regulations	
Efforts	2 SWS lecture, 4 SWS exercise/mechanics lab and 2 h/week self-study	
Frequency of provision	Every summer term	
Duration of module	One semester	
Responsible lecturers	Prof. Dr.-Ing. Daniel Juhre, Prof. Dr.-Ing. Elmar Woschke; FMB	

6.12 Engineering Mechanics 2/3

Course name German name	Engineering Mechanics 2/3 Technische Mechanik 2/3	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: • Students will be familiar with the fundamental concepts and basic methods of Engineering Mechanics in the areas of Strength of Materials and Dynamics and will be able to apply this methodical knowledge. • For strength-related and dynamic problems, they can reproduce simple solution approaches under the interaction of various basic stresses and transfer them to other systems. Utilizing the conveyed principles and the resulting methodical approach, students can analyze solutions and derive fundamental conclusions regarding permissible stresses and strains, acting dynamic loads, or possible vibrations. Upon completion of this module, students will have acquired a basic systemic competence for modeling and calculating simple technical systems, with discussions on the principal influences of deformation behavior and significant dynamic effects.	
	Contents Continuation of Strength of Materials: • Basic loadings: tension/compression, bending, torsion, shear force; combined loadings, failure criteria. Fundamentals of Dynamics: • Kinematic fundamentals of point masses and rigid bodies, kinetics of systems composed of point masses and rigid bodies, energy principles, introduction to the theory of vibrations.	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lectures, exercises and mechanics lab	English
Literature		
Preconditions for attending	Recommended: Engineering Mechanics 1, Mathematics 1	
Usability of module	according to module handbook	
Prerequisites for the provision of ECTS	Preparatory assessment: admission test, laboratory tutorial Examination: written exam K120	
ECTS and marks	5 CP Grading following Study and Examination Regulations	
Efforts	2 SWS lecture, 3 SWS exercise/mechanics lab and 2 h/week self-study	
Frequency of provision	Every winter term	
Duration of module	One semester	
Responsible lecturer	Prof. Dr.-Ing. Daniel Juhre; FMB	

6.13 Fluid Dynamics

Course name German name	Fluid Dynamics Strömungsmechanik	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: After discovering basic concepts of fluid mechanics and fluid dynamics, the students first acquire competences to analyze, understand and predict incompressible flows. They then receive additional knowledge regarding simple compressible flows. Based on this, they are able to solve basic problems of fluid mechanics and fluid dynamics in an autonomous manner. The application exercises complement theoretical explanations with practical case studies for many relevant configurations. At the end of the module, the students can safely use the basic relations of fluid mechanics and fluid dynamics for a broad variety of applications, using in an appropriate manner all conservation laws over suitable control volumes.	
	Contents • Introduction and basic concepts • Important mathematical relations, material derivative • Mass and momentum conservation equations • Hydrostatics and aerostatics • Bernoulli relation for ideal flows • Bernoulli relation for viscous flows involving work exchange • Force and torque induced by a flow • Navier-Stokes equations for viscous flows • Basics of compressible flows • Similarity theory • An introduction to turbulent flows	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lecture and exercises	English
Literature	Lecture book. Frank M. White “Fluid Mechanics” (McGraw Hill)	
Preconditions for attending	Recommended: Mathematics, Physics, Thermodynamics	
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination: Written exam K120	
ECTS and marks	5 CP Grading following Study and Examination Regulations	
Efforts	2 SWS lecture, 2 SWS exercise and 2 h/week self-study	
Frequency of provision	Every winter term	
Duration of module	One semester	
Responsible lecturer	Prof. D. Thévenin; FVST	

6.14 Fundamentals of Machine Elements

Course name German name	Fundamentals of Machine Elements Grundlagen der Maschinenelemente	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: • Acquisition of a fundamental understanding of the functionality of selected machine elements • Learning skills for the dimensioning and recalculation of machine elements • Imparting competencies for the constructive design of machine elements	
	Contents • Springs • Connecting elements • Axles and shafts • Rolling and plain bearings • Clutches and brakes • Gear drives	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lecture and exercises	English
Literature	Schmid, S. R.; Hamrock, B. J.; Jacobson, B. O.: Fundamentals of Machine Elements. CRC Press, 3rd Edition, 2013 Schlecht, B.: Maschinenelemente 1. Pearson Education, 2nd Edition 2015 Schlecht, B.: Maschinenelemente 2. Pearson Education, 1st Edition, 2010 Schlecht, B.: Maschinenelemente – Tabellen und Formelsammlung. Pearson Education, 1st Edition, 2011	
Preconditions for attending	Recommended: Materials, Engineering Design Graphics, Engineering Mechanics 1	
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination prerequisite: Announcement at the beginning of the course Examination: written exam K120,	
ECTS and marks	5 CP Grading following Study and Examination Regulations	
Efforts	Attendance times: 2 SWS lecture, 2 SWS exercises Self-study: pre- and post-preparation of lectures, exercises and exam	
Frequency of provision	Every summer term	
Duration of module	One semester	
Responsible lecturer	Prof. Dr.-Ing. Andre Katterfeld; FMB	

6.15 Fundamentals of Manufacturing Processes

Course name	Fundamentals of Manufacturing Processes	Exam number
German name	Grundlagen der Fertigungslehre	
Teaching aims and content of the module	Learning objectives and competencies to be acquired: The module imparts knowledge in the main groups of primary shaping, forming, machining, joining, coating and change of material properties: • Fundamental knowledge of common manufacturing processes • Understanding of how manufacturing processes are integrated into the production process • Basic knowledge of machine tools and tools • Theoretical foundations of manufacturing • Calculation of simple manufacturing parameters Upon successful completion of the module, students will be able to select appropriate manufacturing processes from the mentioned main groups for a given technical application.	
	Contents In the module, the manufacturing processes, including the necessary machine tools and tools, are explained in accordance with the applicable standards. Based on the classification in the main groups of primary forming, forming, machining, joining, coating and change of material properties, the individual manufacturing processes are explained in terms of their operating principle, area of application and economic aspects. In relation to technological requirements, the module focuses on fundamental relationships and methodological procedures for assessing the applicability of manufacturing processes.	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lecture and exercises	English
Literature		
Preconditions for attending	Recommended: Mathematics, Physics, Materials	
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination: written exam K90,	
ECTS and marks	5 CP Grading following Study and Examination Regulations	
Efforts	Attendance times: 2 SWS lecture, 2 SWS exercises Self-study: pre- and post-preparation of lectures, exercises and exam	
Frequency of provision	Every winter term	
Duration of module	One semester	
Responsible lecturer	Prof. Jüttner, FMB Other teachers: Prof. Hackert-Oschätzchen, FMB	

6.16 Fundamentals of Sustainable Process Engineering

Course name German title	Fundamentals of Sustainable Process Engineering Grundlagen der Nachhaltigen Verfahrenstechnik	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: • Understand the principal features of sustainable process engineering. • Understand how to characterize and sustainably produce substances or materials with desired and defined properties • Able to analyse and optimise the selection, design, and assessment of a number of mechanical, thermal, chemical, and biological processes. • Understand the mathematical description of the properties and behaviour of substances, materials and the processes they are involved in.	
	Contents: There are 5 parts: Mechanical Process Engineering (MPE), Chemical Process Engineering (CPE), Thermal Process Engineering (TPE), Biochemical Engineering (BCE), and Process Systems Engineering (PSE). **MPE**: Characterization of particles, defining shapes; Particle size definitions, theory and practice; Particle size distributions; Particle size measurements; Particle sampling; Dimensionless numbers for particle-fluid interactions. **CPE**: Chemical production based on renewable materials, circular economy; Stoichiometry and thermodynamics of chemical reactions, performance parameters; Chemical kinetics, reaction rate approaches and rate laws; **TPE**: Molecular mixtures and their composition; Overview of separation processes and their principles; Phase change thermodynamics: Ideal equilibria and activity; Dissolution of particles in continuously operated stirred tank; **BCE**: Microorganisms: prokaryotes, eukaryotes and viruses; cultivation of microorganisms, growth kinetics. Upstream processing: Bioreactors, sterilization, sanitization and filtration, inoculum, scale-up. Analysis of bioprocesses: on- and off-line measurements. **PSE**: Overview of process systems in chemistry, biotechnology and energy conversion; Modeling of process systems; Flowsheet simulation; Model-based optimization of process units and systems; Process design and process synthesis.	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lectures 2 SWS + Exercises 2 SWS for 2 semesters	English
Literature	Books recommended and handouts given during the first lecture.	
Preconditions for attending	Thermodynamics, chemistry, fluid mechanics	
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination: written exam K180 with a pass grade	
ECTS and marks	10 CP Marks according to Study and Examination Regulations	
Efforts	Attendance: 112 hours, Self-study: 188 hours	
Frequency of provision	Once per calendar year	
Duration of module	Two semester	
Responsible lecturers	Prof. Dr. Ir. Berend van Wachem, Prof. Dr. Christof Hamel, Prof. Dr. Andreas Voigt, Prof. Dr. Udo Reichl, Prof. Dr. Evangelos Tsotsas, FVST	

6.17 Introduction to AI in Engineering

Course name German title	Introduction to AI in Engineering Einführung Künstliche Intelligenz im Ingenieurwesen	Exam number
Teaching aims and content of the module	Learning objectives and Competencies to be Acquired: • Students will learn major definitions regarding AI • They will learn the fundamentals of AI • They will learn the major AI approaches • They will get to know various examples for using AI to understand how to use AI in the engineering context They will learn about potential problems and risks to be able to judge the possibilities for using AI in specific engineering tasks	
	Contents: • definitions in the field of AI • theoretical backgrounds of AI • various approaches/methods of AI • examples for use of AI in engineering • potential limitations and problems of AI in engineering (sciences)	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lectures and exercises	English
Literature	J. Prosise: Applied Machine Learning and AI for Engineers, 2022 Further literature recommendations will be given at the beginning of the lectures	
Preconditions for attending	Mathematical foundations, some programming skills	
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination: written exam K90, 1 scientific presentation,	
ECTS and marks	5 CP Marks according to Study and Examination Regulations	
Efforts	Attendance: 2 SWS lecture plus 1 SWS exercise; self-learning: pre- and post preparation of lectures, exercise tasks, scientific talk preparation	
Frequency of provision	Every summer semester	
Duration of module	One semester	
Responsible lecturer	Prof. Dr. Hoeschen, FEIT - IMT	

6.18 Introduction to Computer Science for Engineers

Course name German title	Introduction to Computer Science for Engineers Einführung in die Informatik für Ingenieure	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: *Knowledge and Understanding:* Understand the principles of object-oriented programming. Understand and recognize the fundamental data structures such as lists, stacks and queues, trees (binary trees, search trees and AVL trees), hash tables and graphs. Understand and recognize methods to observe algorithm complexity or performance. Understand and recognize the basic algorithms for sorting and searching. Comprehend the fundamental types of algorithm design paradigm such as Divide-and-Conquer, Greedy, Backtracking and Searching, and Dynamic Programming. *Intellectual and Practical Skills:* Distinguish the different types of data structures and algorithm design paradigm evaluate when an algorithmic design situation calls for it. Select appropriate algorithms for basic tasks such as searching and sorting. Design new algorithms or modify existing ones for new application and reason about the efficiency of the result. Program, test and debug computer programs in Java. Communication and *Interpersonal Skills:* Presentation of work and ideas during the tutorials / exercises. Interact with a team and tutors during the tutorials.	
	Contents: Introduction to: imperative programming paradigm; basic concepts of object-oriented programming; programming in a commonly used programming language (e.g. Java, Python); generic programming; fundamental data structures: trees (binary trees, search-trees and AVL trees), hash tables, graphs; abstract data types: lists, stacks, queues; main algorithms for fundamental tasks such as sorting and searching; methods to observe algorithm complexity or performance (Big O notation); fundamental types of algorithm design paradigms: Divide-and Conquer, Greedy, Backtracking and Searching, and Dynamic Programming	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lectures, Exercises on the computer	English
Literature	Computer Science - An Interdisciplinary Approach by R. Sedgewick and K. Wayne, Addison-Wesley, 2016. Algorithms, 4th Edition by R. Sedgewick and K. Wayne, AddisonWesley, 2011, Data Structures and Algorithm in Java, 6th Edition by M.T. Goodrich and R. Tamassia and M.H. Goldwasser, Wiley, 2014	
Preconditions for attending		
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination prerequisite: successful completion of assignments (voting & assessment) Examination: written exam K120,	
ECTS and marks	5 CP, Marks according to Study and Examination Regulations	
Efforts	Attendance times: 150 h, 3 SWS of lecture, 2 SWS of exercise, Self-study: pre- and post-preparation of lectures and exercises, solving of exercises tasks, preparation of exam	
Frequency of provision	Every winter semester	
Duration of module	One semester	
Responsible lecturer	Dr.-Ing. Christian Braune, FIN	

6.19 Introduction to Control Engineering

Course name German name	Introduction to Control Engineering Regelungs- und Steuerungstechnik	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: • students will learn fundamental concepts of feedback control • students will be able to design single input single output linear feedback control systems • students will be able to apply the controller design methods to example systems from mechanical, electrical and chemical engineering	
	Contents • Introduction: control objectives and approaches • Mathematical models based on differential equations • Stability analysis and response behavior of linear time invariant systems • Transfer functions and block diagrams • Control algorithms • Control system design	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lecture and exercises	English
Literature	R. C. Dorf, R. H. Bishop. Modern Control Systems. 14th Edition, Pearson Education, 2021	
Preconditions for attending	Mathematical fundamentals, Introduction to systems theory	
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination: written exam K90	
ECTS and marks	5 CP Grading following Study and Examination Regulations	
Efforts	Attendance times: 2 SWS lecture and 2 SWS exercises Self-study: pre- and post-preparation of lectures, exercises and exam	
Frequency of provision	Every winter term	
Duration of module	One semester	
Responsible lecturer	N.N.; FEIT	

6.20 Introduction to Medical Engineering

Course name German title	Introduction to Medical Engineering Einführung in die Medizintechnik	Exam number
Teaching aims and content of the module	Learning objectives and Competencies to be Acquired: The students will learn what is medical engineering They will understand how patients and medical procedures today benefit from engineering approaches They will learn today's key areas of medical engineering including medical diagnostic and therapeutic approaches They will understand the major cave-ats when working in the medical context as an engineer. They will get an impression on what to look for to make solutions applicable in medical care.	
	Contents: - What is medical engineering? - Major developments of medical engineering for diagnostic and therapeutic use including imaging and sensor approaches - Practical experiments as examples - Patient variability and its meaning for engineering approaches - Safety aspects of medical engineering Prerequisites for applicability of technological developments in medical applications	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lectures, exercise and lab course	English
Literature	M McMahon: Handbook of Medical Engineering, 2015, further literature recommendations will be given at the beginning of the lectures	
Preconditions for attending	Mathematical foundations, Electrical Engineering I, measurement methods	
Usability of module	according to module handbook	
Prerequisites for the provision of ECTS	Examination; exam K90, 2 accepted lab protocols	
ECTS and marks	5 CP Marks according to Study and Examination Regulations	
Efforts	Attendance: 2 SWS lectures, 1 SWS exercises, 1 SWS lab course Self learning: pre- and post-preparation of lectures, lab course, exercise tasks	
Frequency of provision	Each winter term	
Duration of module	One semester	
Responsible lecturer	Prof. Dr. Hoeschen, FEIT - IMT	

6.21 Introduction to Systems Theory

Course name German name	Introduction to Systems Theory Einführung in der Systemtheorie	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: • students will understand fundamental concepts for describing and analyzing linear or linearized time invariant (LTI) systems in continuous and discrete time • students will be able to apply the concepts to simple example systems from mechanical, electrical and chemical engineering • students will be able to understand and apply concepts and methods for spectral analysis of signals	
	Contents • Introduction: definition and classification of signals and systems • Analysis of continuous LTI systems in the time domain • Laplace transformation • Analysis of continuous LTI systems in the Laplace domain • Fourier Transformation and spectral analysis • Analysis of discrete time LTI systems in the time domain • z-Transformation • Analysis of discrete time LTI systems in the z-domain	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lecture and exercises	English
Literature		
Preconditions for attending	Mathematical fundamentals	
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination: written exam K90	
ECTS and marks	5 CP Grading following Study and Examination Regulations	
Efforts	Attendance times: 2 SWS lecture and 2 SWS exercises Self-study: pre- and post-preparation of lectures, exercises and exam	
Frequency of provision	Every summer term	
Duration of module	One semester	
Responsible lecturer	Prof. Achim Kienle; FEIT-IFAT	

6.22 Language

Course name German name	Language Sprache	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: International students will acquire basic knowledge of the German language. Depending on their knowledge level students will be streamed into levels A1–B2. Students learn German as a foreign language in different classes according to their entry level. Students with German as their native language attend the English course "English in Engineering" (B2).	
	Contents Language course teaching • Listening • Reading • Writing • Grammar • Speaking depending on the knowledge level of the student,	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Language course	German as a foreign language or English
Literature		
Preconditions for attending	German as a foreign language: Placement Test English: B2	
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS		
ECTS and marks	10 CP Grading following Study and Examination Regulations	
Efforts	Attendance times: 4 SWS seminar in German as a foreign language (compulsory attendance 75 percent) 2 SWS seminar in English (compulsory attendance 75 percent) Self-study: preparation and follow-ups of seminars and exams	
Frequency of provision	Every year	
Duration of module	Two semesters	
Responsible lecturer	N.N.	

6.23 Materials I

Course name German name	Materials I Werkstoffe I	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: A fundamental understanding of the structure of materials is a prerequisite for their application, design, and manufacturing processing. In this module, students acquire the basics of materials science with a focus on the internal structure and the resulting structure-property relationships. Students learn to describe and analyze materials science issues and to apply this knowledge independently in the development of materials and products. They can also assess material testing methods based on their performance and use them purposefully. Questions regarding material properties, production, and application can be confidently addressed using the acquired knowledge. The analysis of microstructural processes in the material classes of metals and non-metals is mastered at a basic level.	
	Contents • Solid state structures • Phases and phase transformations • Binary phase diagrams • Heat treatment of metallic structural materials • Mechanical testing and technological properties	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Experimental lectures, seminar-style exercises, and practical teamwork on a given problem in small, independently working groups	English
Literature		
Preconditions for attending	Recommended: basic knowledge in chemistry and physics at high school graduation level	
Usability of module	According to module handbook, Usuable as Erasmus exchange module	
Prerequisites for the provision of ECTS	Examination prerequisite: Announcement at the beginning of the course Examination: written exam K90,	
ECTS and marks	5 CP Grading following Study and Examination Regulations	
Efforts	Attendance times: 2 SWS lecture, 1 SWS exercises, 1 SWS laboratory tutorial Self-study: pre- and post-preparation of lectures, exercises and exam	
Frequency of provision	Every winter term	
Duration of module	One semester	
Responsible lecturer	Prof. Halle, FMB	

6.24 Materials II

Course name German name	Materials II Werkstoffe II	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: A prerequisite for understanding construction and selected functional materials as well as their application, design, and manufacturing processing is a central understanding of microstructure-property relationships. In this module, students will learn advanced content in materials science, focusing on intrinsic mechanisms and specific material properties. Students are capable of analyzing specialized and in-depth problems and implementing solutions within practical issues related to material and product development. In doing so, they utilize the competencies acquired in the areas of material properties, material manufacturing, and the targeted modification of properties through heat treatment.	
	Contents • Complex mechanical properties • Selected electrical, thermal, magnetic, and optical properties • Special issues of heat treatment in metallic materials • Chemical properties • Selected methods of material manufacturing	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Experimental lectures, seminar-style exercises, and practical teamwork on a given problem in small, independently working groups	English
Literature		
Preconditions for attending	recommended: Materials I	
Usability of module	According to module handbook, Usuable as Erasmus exchange module	
Prerequisites for the provision of ECTS	Examination prerequisite: Announcement at the beginning of the course Examination: written exam K90,	
ECTS and marks	5 CP Grading following Study and Examination Regulations	
Efforts	Attendance times: 2 SWS lecture, 1 SWS exercises, 1 SWS laboratory tutorial Self-study: pre- and post-preparation of lectures, exercises and exam	
Frequency of provision	Every summer term	
Duration of module	One semester	
Responsible lecturer	Prof. Scheffler; FMB Additional lecturers: Dr. Betke, FMB	

6.25 Mathematics M1e

Course name German name	Mathematics M1e Mathematik M1E		Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: The students acquire comprehension of and familiarity with concepts and methods that are relevant to subject-specific classes in the areas of engineering and computer science. They develop technical skills by applying those methods, in particular to subject-specific examples. The topical focus of the module is on an introduction to linear algebra.		
	Contents • Complex numbers • Real and complex vectors • Matrices • Determinants • Linear maps • Eigenvalues (introduction) • Systems of linear equations		
DQR Module level	Niveau 6: Bachelor		
Teaching forms | language	Lecture and exercises		English
Literature			
Preconditions for attending			
Usability of module	According to module handbook		
Prerequisites for the provision of ECTS	Announcement at the beginning of the semester Examination: written exam K75		
ECTS and marks	5 CP Grading following Study and Examination Regulations		
Efforts		In class	Self-study
	Lecture Mathematics M1e	3 SWS / 42 h	66 h
	Global tutorial Mathematics M1e	2 SWS / 28 h	
	Group tutorial Mathematics M1e	1 SWS / 14 h	
Frequency of provision	Every winter term		
Duration of module	One semester		
Responsible lecturer	Prof. V. Kaibel; FMA-IMO		

6.26 Mathematics M2e

Course name German name	Mathematics M2e Mathematik M2E		Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: The students acquire comprehension of and familiarity with concepts and methods that are relevant for subject-specific classes in the areas of engineering and computer science. They develop technical skills by applying those methods, in particular to subject-specific examples. The topical focus of the module is on an introduction to calculus.		
	Contents • Convergence and continuity • Differential calculus (1-dimensional) • Ordinary differential equations (examples, methods to solve homogeneous linear ODE's of second order with constant coefficients) • Calculus of integrals (1-dimensional) • Differential calculus (n-dimensional) • Examples of partial differenzial equations		
DQR Module level	Niveau 6: Bachelor		
Teaching forms | language	Lecture and exercises		English
Literature			
Preconditions for attending			
Usability of module	According to module handbook		
Prerequisites for the provision of ECTS	Announcement at the beginning of the semester Examination: written exam K75		
ECTS and marks	5 CP Grading following Study and Examination Regulations		
Efforts		In class	Self-study
	Lecture Mathematics M2e	3 SWS / 42 h	66 h
	Global tutorial Mathematics M2e	2 SWS / 28 h	
	Group tutorial Mathematics M2e	1 SWS / 14 h	
Frequency of provision	Every summer term, Every winter term		
Duration of module	One semester		
Responsible lecturer	Prof. Th. Richter; FMA-IAN		

6.27 Mathematics M3e

Course name German name	Mathematics M3e Mathematik M3E		Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: The students acquire comprehension of and familiarity with concepts and methods that are relevant for subject-specific classes in the areas of engineering and computer science. They develop technical skills by applying those methods, in particular to subject-specific examples. The topical focus of the module is on stochastics as well as on advanced topics in Linear Algebra and Calculus.		
	Contents • Probability and statistics • Eigenvalues (deeper treatment, in particular diagonalization) • Power series • Fourier series • Ordinary differential equations (e.g., Picard-Lindel¨of, scalar ODE's with separated variables, linear systems of ODE's with constant coefficients, variation of the constant)		
DQR Module level	Niveau 6: Bachelor		
Teaching forms | language	Lecture and exercises		English
Literature			
Preconditions for attending	Strongly recommended: Mathematics M1, Mathematics M2		
Usability of module	According to module handbook		
Prerequisites for the provision of ECTS	Announcement at the beginning of the semester Examination: written exam K75		
ECTS and marks	5 CP Grading following Study and Examination Regulations		
Efforts		In class	Self-study
	Lecture Mathematics M3e	3 SWS / 42 h	66 h
	Global tutorial Mathematics M3e	2 SWS / 28 h	
	Group tutorial Mathematics M3e	1 SWS / 14 h	
Frequency of provision	Every winter term		
Duration of module	One semester		
Responsible lecturer	Prof. R. Altmann; FMA-IAN		

6.28 Mathematics M4e

Course name German name	Mathematics M4e Mathematik M4E		Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: The students acquire comprehension of and familiarity with concepts and methods that are relevant for subject-specific classes in the areas of engineering and computer science. They develop technical skills by applying those methods, in particular to subject-specific examples. The topical focus of the module is on stochastics as well as on advanced topics in Linear Algebra and Calculus.		
	Contents • Calculus of integrals (n-dimensional) • Vector analysis • Path integrals • Surface integrals • Integral Theorems • Fourier-transformation (one- and two-dimensional) • Partial differential equations		
DQR Module level	Niveau 6: Bachelor		
Teaching forms | language	Lecture and exercises		English
Literature			
Preconditions for attending	Strongly recommended: Mathematics M1, Mathematics M2		
Usability of module	According to module handbook		
Prerequisites for the provision of ECTS	Announcement at the beginning of the semester Examination: written exam K75		
ECTS and marks	5 CP Grading following Study and Examination Regulations		
Efforts		In class	Self-study
	Lecture Mathematics M4e	3 SWS / 42 h	66 h
	Global tutorial Mathematics M4e	2 SWS / 28 h	
	Group tutorial Mathematics M4e	1 SWS / 14 h	
Frequency of provision	Every summer term		
Duration of module	One semester		
Responsible lecturer	Prof. M. Simon; FMA-IAN		

6.29 Measurement Methods

Course name German name	Measurement Methods Messtechnik	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: Students acquire basic knowledge of measurement technology and the ability to analyze errors in measurement signals. Upon successful completion of the module, they will also have the skills to determine resistances and impedances using suitable circuits. They will also learn the key principles of signal amplification. The lecture provides basic knowledge on how to select and use electrical measurement systems and how to critically evaluate and classify the results of the analysis. In the exercises, students will be able to deepen their knowledge and skills, communicate and apply them to complex problems.	
	Contents • Introduction to metrology: Definitions and terms of metrology Measurement systems, units, natural constants, classification of measurement signals, measurement signals as information carriers, measurement conversion and structures • Measurement deviations: Description of measurement deviations, systematic and stochastic component of measurement deviation, errors of measuring devices, dynamic measurement deviation • Resistance and impedance measurement, bridge circuits • Operational amplifier (OPV): ideal & real OPV, typical circuits, mathematical operations with OPV • Digital measurement technology for time and frequency	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lecture and exercises	English
Literature		
Preconditions for attending	Recommended: Electrical engineering, Mathematics	
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination: written exam K90	
ECTS and marks	5 CP Grading following Study and Examination Regulations	
Efforts	Attendance times: 2 SWS lecture, 2 SWS exercises Self-study: pre- and post-preparation of lectures, exercises and exam	
Frequency of provision	Every winter term	
Duration of module	One semester	
Responsible lecturer	Frau Prof. Dr.-Ing. Ulrike Steinmann; FEIT-IFAT	

6.30 Microsystems

Course name German title	Microsystems Microsysteme	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: The overall objective is to gain a general overview of micro systems (MEMS) engineering, both the functional and physical aspects and the fabrication. In the first third of the course, we discover what happens with mechanics, fluidics and optics when we miniaturize a system, which effects dominate on the micro scale. We will also discuss the basic elements of micro mechanics and the standard micro actuator concepts. After completing this part, the students can do rough analytical estimates of the behavior of micro systems, they know the dominating and limiting effects and standard building blocks and can recognize how specific micro systems function. In the second two thirds, we discuss the traditional (clean-room based) and modern (clean room free, rapid prototyping) micro fabrication processes and characterization methods. From this part, the students will know an overview of the most relevant micro systems and micro electronics fabrication and characterization processes with their characteristic properties, capabilities and limitations. They will know the challenges of micro systems fabrication and their impact on MEMS design.	
	Contents: Miniaturization, scaling behaviour: • Micromechanics and actuators; micro fluidics and optics Micro processes: • Cleanroom, materials • optical, e-beam and x-ray lithography, resists • physical and chemical deposition; diffusion, oxidizazion • wet and dry substractive (etching) processes, DRIE • back end processes, LIGA • rapid prototyping (laser ablation, 2-photon lighography, printing) Characterization methods: • Electron microscope, force microscope, • optical profilometer, laser vibrometer, interferometer • spectroscopy methods (atomic analysis) diffraction methods (crystallography)	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lectures	Englisch
Literature		
Preconditions for attending		
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination: written exam K90	
ECTS and marks	5 CP Marks according to Study and Examination Regulations	
Efforts	Attendance times: 4 SWS lectures Self-study: Preparation and wrap-up of lectures, literature studies	
Frequency of provision	Each summer semester	
Duration of module	One Semester	
Responsible lecturer	Prof. Dr. Wapler, FEIT	

6.31 Modelling and Simulation of Process Systems

Course name German title	Modelling and Simulation of Process Systems Simulationstechnik und Prozessdynamik	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: The students are introduced to basic modelling concepts of chemical engineering process operations. The learn to combine balancing equations with kinetic expressions for a dynamical simulation of basic process units like a batch and continuously stirred tank reactor. They implement and solve differential equations in MatLab to acquire basic programming skills.	
	Contents: • Basis principles of material and energy balances • Thermodynamics and kinetics for biochemical reactions • Dynamics and steady-state operations of reactors • Introduction to MatLab for solving differential equations • Applications of MatLab simulations to basic unit operations	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lectures, exercises and tutorings	Englisch
Literature	Bequette: Process Dynamics, Chidabaram: Mathematical modeling and simulation in chemical engineering	
Preconditions for attending	Mathematics 1+2	
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination: Two parts: Practical computer programming task using MatLab K60 (50%) written exam K60 with paper and pencil only (50%)	
ECTS and marks	5 CP Marks according to Study and Examination Regulations	
Efforts	2 SWS lecture, 1 SWS exercise and 4h/week self-study	
Frequency of provision	Every summer semester	
Duration of module	One semester	
Responsible lecturer	Dr. Andreas Voigt, FVST	

6.32 Numerical Methods for Simulation

Course name German name	Numerical Methods for Simulation Numerische Simulationsmethoden	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: • In the course, students acquire knowledge in the application of numerical, computer-oriented methods through practical examples. They can articulate the assumptions and fundamental concepts for solving corresponding problem classes and analyze the results. • Students are capable of applying various methods within the scope of simpler problem scenarios. Upon completion of this module, students have gained an overview of relevant numerical simulation methods in engineering and can deepen their understanding through self-study or in advanced modules.	
	Contents • Introduction to Mathematical Modelling • Finite Difference Methods (FDM) • Introduction to the Finite Element Method (FEM) • Introduction to the Calculation of Multibody Systems (MBS) • Introduction to the Discrete Element Method (DEM) • Introduction to the Computational Fluid Dynamics (CFD)	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lecture and exercises	English
Literature		
Preconditions for attending	Recommended: Engineering Mechanics 1 and 2/3, Mathematics 1-2	
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Term paper: written documentation (40% of the final grade) Examination: written exam K90 (60% of the final grade)	
ECTS and marks	5 CP Grading following Study and Examination Regulations	
Efforts	2 SWS lecture, 2 SWS exercise and 2 h/week self-study	
Frequency of provision	Every winter term	
Duration of module	One semester	
Responsible lecturer	Prof. D. Juhre, Prof. A. Katterfeld, Prof. E. Woschke; FMB	

6.33 Physics I

Course name German name	Physics I Physik I	Exam number
Teaching aims and content of the module	This course introduces students to mechanics, fluid dynamics, and oscillations, while establishing a strong foundation in experimental physics. Through experimental demonstrations and mathematical methods, students develop both inductive and deductive reasoning skills and gain proficiency in measuring physical quantities, essential for physical understanding.	
	Contents • Kinematics • Dynamics of point masses and rigid body • Conservation laws • Mechanics of continua • Hydrostatics and hydrodynamics • Oscillations and acoustics	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lecture, tutorials	English
Literature		
Preconditions for attending		
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination: Written Exam (90 min) for Physics I The eligibility criteria for the exam will be announced in the first lecture	
ECTS and marks	5 CP Grading following Study and Examination Regulations	
Efforts	Presence times: 2 SWS lecture with experiments, 1 SWS lecture tutorial, 1 SWS class tutorial Self-study: pre- and post-preparation of lectures and exercises, study of literature	
Frequency of provision	Each winter semester	
Duration of module	One semester	
Responsible lecturer	Jun.-Prof. Hendrik Mattern, FNW	

6.34 Physics II

Course name German name	Physics II Physik II	Exam number
Teaching aims and content of the module	This physics course introduces students to electromagnetism, optics, and early quantum mechanics, establishing a strong foundation in experimental physics. Through experimental demonstrations and mathematical methods, students develop both inductive and deductive reasoning skills and gain proficiency in measuring physical quantities, essential for physical understanding.	
	Contents • Electrostatics • Electric circuits • Electromagnetic fields • Geometric and wave optics • Early quantum theory and models of the atom	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lecture, tutorials	English
Literature		
Preconditions for attending		
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination: Written Exam (90 min) for Physics II The eligibility criteria for the exam will be announced in the first lecture	
ECTS and marks	5 CP Grading following Study and Examination Regulations	
Efforts	Presence times: 2 SWS lecture with experiments, 1 SWS lecture tutorial, 1 SWS class tutorial Self-study: pre- and post-preparation of lectures and exercises, study of literature	
Frequency of provision	Each summer semester	
Duration of module	One semester	
Responsible lecturer	Jun.-Prof. Hendrik Mattern, FNW	

6.35 Preparation Principles of Porous Materials

Course name German title	Preparation Principles of Porous Materials Präparationsprinzipien poröser Materialien	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: Porous materials play an important role in several technical processes as catalysts, adsorbents or ion exchanger. Synthesis pathways and principles to obtain inorganic porous and cellular structures are discussed in general as well as for some selected materials. Students learn which characterization methods can be used in particular. The most important industrial applications are presented. Special focus lies on modern trends in research and application.	
	Contents: • Principles of synthesis and preparation methods to obtain inorganic porous materials • Strategies and process aspects for the preparation of zeolites and zeolite like materials • Description of the hydrothermal crystallisation process of silicates • Crystallisation techniques and methods • Characterisation methods for porous materials • Production and processing of amorphous silica and porous glasses • Al-rich zeolites and high-silica structures • Alumophosphates – class of novel materials with interesting pore size and geometry, applicationen • Mesoporous materialis – products with a new dimension of pores • Metall organic frameworks (MOF) • Specialties – taylor made products by special methods • Layered silicates as base structure for 3D-frame work • supported crystallisation • Postsynthesis to modify the properties • Shaping and posttreatment – important precondition for application	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lecture	English
Literature		
Preconditions for attending	Basic courses organic and inorganic chemistry	
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination: written exam K90	
ECTS and marks	5 CP Marks according to Study and Examination Regulations	
Efforts	Lectures and tutorials: 3 SSW, (2 lecture, 1 tutorial) Private studies: 96 h	
Frequency of provision	Every summer semester	
Duration of module	One semester	
Responsible lecturer	Prof. Dr. Franziska Scheffler, FVST	

6.36 Product quality in the chemical industry

Course name	Product Quality in the Chemical Industry	Exam number
German name	Produktqualität in der Chemischen Industrie	
Teaching aims and content of the module	Learning objectives and competencies to be acquired: Students know and understand typical quality profiles for products of the chemical and process industry, the relationship between structure and functionality of complex products, and opportunities and methods for product design.	
	Contents • Fundamentals of product design and product quality in the chemical industry (differences to machines and machine elements, customer orientation, multi- dimensionality and complexity as opportunities for product design) • Formulation and properties of granular materials (dustiness, fluidizability, storage, color and taste, pourability, adhesion and cohesion, bulk density, redispersibility, instantization etc.) • Detergents (design by composition and structure, molecular fundamentals and forces, tensides and their properties, competitive aspects of quality, alternative design possibilities, production procedures) • Solid catalysts (quality of active centers, function and design of catalyst carriers, catalyst efficiency, formulation, competitive aspects and solutions in the design of reactors, esp. of fixed bed reactors, remarks on adsorption processes) • Drugs (quality of active pharmaceutical ingredients and formulations, release kinetics and retard characteristics, coatings, microencapsulation, implants, further possibilities of formulation) • Clean surfaces (the "Lotus Effect", its molecular background and its use, different ways of technical innovation) • Short introduction to quality management after ISO	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lecture, lab exercises, workshop	English
Literature	Handouts will be given in lecture	
Preconditions for attending	Recommended: Chemistry, Fundamentals of Sustainable Process Engineering	
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Written exam K90	
ECTS and marks	5 CP Grading following Study and Examination Regulations	
Efforts	3 hours per week, Lectures and tutorials: 42 h, Private studies: 108 h	
Frequency of provision	Every summer term	
Duration of module	One semester	
Responsible lecturer	Prof. Dr.-Ing. Evangelos Tsotsas	

6.37 Python for Engineers

Course name German title	Python for Engineers	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: - Understanding the basics of Python - Understanding the structure and control in Python - Understanding basic modules, such as Numpy and Matplotlib - Style of coding, debugging, and the role of comments - Being able to develop algorithms for engineering problems	
	Contents: 1. The basics of Python 2. Structure and control in Python 3. Numpy and Matplotlib and other imports 4. Algorithms, efficiency and optimization 5. Developing an algorithm in Python for an engineering application	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lectures 2 SWS + Exercises 2 SWS for 1 semester	English
Literature	Lecture notes provided	
Preconditions for attending		
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination prerequsites:3 hand-ins Examination: written exam K180 with a pass grade	
ECTS and marks	5 CP Marks according to Study and Examination Regulations	
Efforts	Attendance: 56 hours, Self-study: 94 hours	
Frequency of provision	Every summer semester	
Duration of module	One semester	
Responsible lecturer	M.Sc. Max Hausmann, Prof. Dr. Ir Berend van Wachem, FVST	

6.38 Scientific work & Project work

Course name German name	Scientific work & Project work Wissenschaftliches Arbeiten & Projektarbeit	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: Students understand what scientific working means. They learn how to write scientific documents (report, thesis, conference / journal publication) in regard to the argumentation structure as well as the formal requirements. They can identify unethical behavior in engineering practice. Like in industrial reality students learn to work in group and teams to solve an engineering problem. They can work in groups on an engineering project and can handle the social and organizational problems associated with team work. They plan and document the necessary work packages to solve a problem in a limited amount of time. Finally, they will present their solution and learn to critically evaluate own results and the results from other groups.	
	Contents • Introduction in scientific thinking and writing in engineering • Introduction to engineering ethics • Basics of work in a team • Basics of project management • Introduction to software tools to solve engineering problems	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lecture, seminars, project work	English
Literature		
Preconditions for attending		
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Scientific project consisting out of Project report (33,33%) Project presentation (33,33%) Electronical exam 30 min (33,33%)	
ECTS and marks	10 CP Grading following Study and Examination Regulations	
Efforts	Attendance times: 1 SWS lecture, 2 SWS seminars Self-study: pre- and post-preparation of lectures, project work in groups	
Frequency of provision	Once year	
Duration of module	Two semester	
Responsible lecturer	N.N., FMB	

6.39 Sustainable Chemical Process Technology

Course name	Sustainable Chemical Process Technology	Exam number
German name	Nachhaltige Chemische Prozesstechnologien	
Teaching aims and content of the module	Learning objectives and competencies to be acquired: Acquisition of a basic understanding of selected large-scale processes in chemistry and chemical process engineering Handling and analyzing of the design of processes with renewable raw materials including To categorize power-to-chemicals concepts and in particular the central role of hydrogen and the path to climate-neutral chemical production	
	Contents • Material and technical aspects of industrial chemistry using the example of selected processes and products • Hierarchical structure of the production process, VT flow sheets • Process selection and process development, preliminary and main studies of process development and process synthesis • Energy requirements, environmental impact, plant safety • Options for chemical production without use of fossil raw materials (defossilized chemistry) • Chemicals based on renewable raw materials, C_2/C_3 basic chemicals, bioplastics • Integrated production based on renewable raw materials – lignocellulose, biogas and synthesis gas biorefinery • Circular economy – utilization of plastic waste: Challenges/recycling/chemical recycling/pyrolysis and gasification • Power-to-chemicals concepts: power-to-gas – introduction/electrolysis and electrolyzers for hydrogen/co-electrolysis for syngas, ethylene, ammonia/P-2-chemicals production chains/role of the electricity system • The central role of hydrogen: hydrogen use/color theory • Climate-neutral chemical production in 2050 – how to get there	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lecture, tutorials, lab classes	English
Literature	Moulijn, van Diepen, Chemical Process Technology, Wiley, 2001 Behr, Seidensticker, Chemistry of Renewables: An Introduction, Springer 2020	
Preconditions for attending	Recommended: Chemistry, Fundamentals of Sustainable Process Engineering	
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Written exam K90	
ECTS and marks	5 CP Grading following Study and Examination Regulations	
Efforts	2 SWS lecture, 1 SWS exercise and 3 h/week self-study	
Frequency of provision	Every summer term	
Duration of module	One semester	
Responsible lecturer	Prof. Hamel, FVST	

6.40 Technical Risks

Course name	Technical Risks	Exam number
German name	Technische Risiken	
Teaching aims and content of the module	Learning objectives and competencies to be acquired: • Students know hazards caused by materials handled in industry, industrial processes and facilities, • have a basic knowledge about the main hazards –emission, fire, explosion and radioactivity, • are able to analyze reasons for accidental releases of hazardous substances and • apply computational methods for effects of incidents like heat and pressure waves, toxic clouds	
	Contents • Introduction, definitions and case studies • Accidental releases and dispersion of hazardous materials in the atmosphere • Fire in industrial plants, spread of fire – models, heat and mass balance in pool fires and fire plumes • Explosions in industrial facilities, reasons, development of explosible mixtures, protection measures • Hazardous exothermic reactions, thermal explosion theory • Endangerments by radioactive radiation, calculation of activity, protection, and determination of doses • Methods of risk analysis for industrial facilities • Reliability of technical components and systems	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lecture	English
Literature	• Frank, L., Lees' Loss Prevention in the Process Industries: Hazard Identification, Assessment and Control. 2012, Boston: Butterworth-Heinemann. • Hauptmanns, U., Process and Plant Safety, Springer, 2015 • Hattwig M, Steen H. (eds.), Handbook of explosion protection, Wiley VCH, 2004	
Preconditions for attending	Mathematics, Fluid Dynamics, Chemistry, Thermodynamics	
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Written exam K120	
ECTS and marks	5 CP Oral examination	
Efforts	2+1 SWS (28 h lectures+14 h seminar/exercise) self-dependent studies	
Frequency of provision	Every winter term	
Duration of module	One semester	
Responsible lecturer	Prof. Dr.-Ing. habil. Ulrich Krause, FVST	

6.41 Thermodynamics

Course name German name	Thermodynamics Thermodynamik	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: Fundamentals of energy transfer and conversion, as well as the balancing and state behavior of thermodynamic systems.	
	Contents • Introduction • Heat as a form of energy transfer • Thermal conduction (steady and unsteady) • Natural and forced convection • Energy transport by radiation • Heat exchangers • Work and internal energy • Thermodynamic laws • State behavior of simple substances • Processes in machines, devices, and systems – energetic evaluation • Energy and the environment	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Lecture and exercises	English
Literature		
Preconditions for attending	Recommended: Mathematics, Physics	
Usability of module	According to module handbook	
Prerequisites for the provision of ECTS	Examination: Written exam K120	
ECTS and marks	5 CP Grading following Study and Examination Regulations	
Efforts	2 SWS lecture, 2 SWS exercise and 2 h/week self-study	
Frequency of provision	Every summer term	
Duration of module	One semester	
Responsible lecturer	Prof. Beyrau; FVST	

7 Bachelorarbeit | Bachelor Thesis

Course name German title	Bachelor Thesis Bachelorarbeit	Exam number
Teaching aims and content of the module	Learning objectives and competencies to be acquired: The objective is to demonstrate that within a specified deadline, a problem from all three engineering specialization disciplines can be addressed using scientific methods under guidance. Upon successful completion of the module, students are also capable of presenting and defending solutions they have developed in a structured manner.	
	Contents: The topic of the bachelor's thesis can be derived from current research projects of the institutes or from industrial tasks with a scientific character. The thesis task is always issued by a university professor from the faculties involved in the program. In the colloquium, students must demonstrate that they are capable of defending the results of their scientific work on a subject area in a technical discussion. In the colloquium, the topic of the bachelor's thesis and the associated problems and findings should be presented in a lecture of no more than 20 minutes (reduced to 15 minutes per student in group examinations), and related questions should be answered.	
DQR Module level	Niveau 6: Bachelor	
Teaching forms | language	Project work, bachelor thesis, bachelor colloquium	English
Literature		
Preconditions for attending	for the start of processing: Proof of 140 ECTS credits from the compulsory and elective modules Prerequisite for the colloquium: Proof of all necessary 165 CP Grade from the reviews of the bachelor's thesis at least "satisfactory" (4.0)	
Usability of module	B-EngSci	
Prerequisites for the provision of ECTS		
ECTS and marks	15 CP (12 CP Bachelor thesis, 3 CP colloquium) Marks according to Study and Examination Regulations	
Efforts	Independent scientific work, documentation, presentation	
Frequency of provision	Ongoing	
Duration of module	12 weeks Issuance of the topic and submission of the bachelor's thesis are officially recorded in the Examination Office of the Faculty of Mechanical Engineering.	
Responsible lecturer	University lecturers including Prof., Jun.-Prof. and Privatdozenten From the faculties FMB, FEIT, FVST	