

OTTO-VON-GUERICKE-UNIVERSITÄT MAGDEBURG

Fakultät für Maschinenbau



**Modulhandbuch
für den Masterstudiengang
Biomechanical Engineering**

**Module Handbook
for the Masters Program
Biomechanical Engineering**

M-BiME

zur

studiengangsspezifischen Studien- und Prüfungsordnung (sSPO 2024),
veröffentlicht als amtliche Bekanntmachung 02/2024,
geändert durch die erste Satzung zur Änderung der sSPO,
veröffentlicht als amtliche Bekanntmachung 04/2025
zuletzt geändert durch die zweite Satzung zur Änderung der sSPO,
veröffentlicht als amtliche Bekanntmachung 32/2026

program-specific study and examination regulations (sSPO) (sSPO 2024),
published in Germany under "Amtliche Bekanntmachung Nr. 02/2024",
amended by the first statutes amending the sSPO,
published in Germany under "Amtliche Bekanntmachung Nr. 04/2025"
last amended by the second statutes amending the sSPO,
published in Germany under "Amtliche Bekanntmachung Nr. 32/2026.

ab Immatrikulation Wintersemester 2025-26

as of enrollment winter semester 2025-26

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1 Kurzbeschreibung des Studiengangs | Description of the study program

Name des Studiengangs:	Biomechanical Engineering	Name of the Study program:	Biomechanical Engineering
Art des Studiengangs:	Präsenzstudiengang (Vollzeitstudium)	Type of Course of studies:	Attendance course of studies (full-time study)
Abschluss:	Master of Science (M. Sc.)	Degree:	Master of Science (M. Sc.)
Umfang:	4 Semester	Duration:	4 semesters
Profil:	„stärker forschungsorientiert“	Profile:	„more research-oriented“

Ausbildungsergebnisse

(Fachliche Kompetenzen):

Der Masterstudiengang „Biomechanical Engineering“ ist forschungs- und methodenorientiert und fokussiert nach einem medizintechnisch orientierten oder ingenieurwissenschaftlichen Bachelorstudium inhaltlich auf die Entwicklung medizintechnischer Produkte mit der Anwendung im oder am Menschen und geht qualitativ deutlich über die Ausbildungsziele des jeweiligen Vorstudiums hinaus.

Durch sein curriculares Angebot können spezifische und Schnittstellen-Kompetenzen in den Bereichen Konstruktion und Materialwissenschaft sowie Medizin und Produktrecht herausgebildet werden, wobei die ingenieurorientierte Lösung innerhalb einer starken interdisziplinären Ausrichtung im Mittelpunkt steht. Das Studium befähigt die Studierenden, die im Studium erworbenen Kenntnisse und Fähigkeiten in theoretischen und anwendungsbezogenen Problemstellungen selbstständig, ganzheitlich und lösungsorientiert sowie interdisziplinär zu bearbeiten und in der beruflichen Praxis sowie in der weiterführenden Forschung anzuwenden. Zudem sollen die Absolventinnen und Absolventen über die allgemein zu erreichenden Ziele des Masterstudiums hinaus befähigt werden, sich in vielfältige Aufgaben einzuarbeiten, Probleme zu identifizieren und zu lösen sowie für ein technisch orientiertes, verantwortungsbewusstes Arbeiten sensibilisiert werden.

Ziel ist es, fachliche und methodische Kompetenzen herauszubilden, die eine ganzheitliche Betrachtung von biomedizinisch-technischen Zusammenhängen basierend auf einem fundierten grundlagenorientierten Wissen ermöglichen und im Zuge eines lebenslangen Lernens gewährleisten, sich

Educational Results

(professional competences):

The master degree program "Biomechanical Engineering" is research- and method-oriented and focuses on the development of medical-technical products with applications in or on humans after receiving a medical-technical or engineering bachelor's degree. It clearly deepens and intensifies the educational aims of the respective pre-studies.

By its curriculum, specific and interface competences can be developed in the areas of design and materials science as well as medicine and product law, focusing on engineering-oriented solutions within a strong interdisciplinary orientation. The program enables students to apply the knowledge and skills acquired in the course of study to theoretical and application-related problems independently, holistically and in a solution-oriented and interdisciplinary manner, and to apply them in professional practice as well as in further research. In addition, the graduates should be enabled, beyond the general aims of the master's program, to familiarize themselves with a variety of tasks, to identify and solve problems, and to be sensitized to technically oriented, responsible work.

The aim is to develop professional and methodological competences that enable a holistic view of biomedical-technical contexts based on a substantial basic knowledge and ensure that new and in-depth knowledge can be acquired quickly in the course of lifelong learning. In the master degree program with

schnell neue, als auch vertiefende Kenntnisse anzueignen. In dem 4-semesterigen Masterstudien-gang erwerben die Absolventen und Absolventinnen neben biomechanischen und medizintechnischen auch soziale und rechtliche Kenntnisse und bilden Kompetenzen heraus, die sie befähigen,

- über Inhalte und Probleme von biomechanischen Medizinprodukten und deren angrenzenden 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.

Die Studierenden erlangen die Fähigkeiten, auf ihrem Fachgebiet Meinungen kritisch zu hinterfragen, anstehende Probleme wissenschaftlich strukturiert unter Berücksichtigung angrenzender Fachdisziplinen zu lösen und ihre erarbeitete Lösung vor Fachkollegen und Laien zu vertreten bzw. ihr Wissen zu vermitteln. Sie sind dazu in der Lage, ihr Fachgebiet über den aktuellen Stand der Technik hinaus kreativ weiterzuentwickeln. Auch auf der Grundlage begrenzter Informationen können die Absolventen und Absolventinnen wissenschaftlich fundierte Entscheidungen treffen und dabei gesellschaftliche und ethische Erkenntnisse berücksichtigen.

Absolventinnen und Absolventen sind qualifiziert, Problemlösungsstrategien anzuwenden, um Anforderungen des jeweiligen biomechanischen Medizinproduktbereichs abzuleiten und systematisch Lösungen zu erarbeiten.

a duration of 4 semesters, graduates acquire not only biomechanical and medical-technical knowledge, but also social and legal knowledge, and develop competences that enable them to:

- communicate with experts about the contents and problems of biomechanical medical devices and their related disciplines,
- carry out projects,
- work individually and in an integrated manner as a member of international groups,
- assume leadership responsibility and
- be committed, goal-oriented, task-oriented and willing to learn in various professional fields.

The students acquire skills to critically question opinions in their field of expertise, to solve upcoming problems in a scientifically structured manner, taking into account related disciplines, and to present their solutions to colleagues and laypersons or to communicate their knowledge. They are able to creatively develop their field of expertise beyond the current state of the art. Even on the basis of limited information, graduates are able to make scientifically substantiated decisions, taking social and ethical findings into account.

Graduates are qualified to apply problem-solving strategies to derive requirements of the respective biomechanical medical device field and to develop systemic solutions.

Ausbildungsergebnisse

(Soziale Kompetenzen):

Im Studienverlauf erhalten die Studierenden über Qualifizierungsarbeiten und ein interdisziplinäres Teamprojekt Zugang zu den vorhandenen Forschungsschwerpunkten.

Die Studierenden werden entsprechend qualifiziert, um nach dem Abschluss des Masterstudiums unterschiedliche Karrierewege einschlagen zu können:

- Einerseits soll durch die Teilhabe der Studierenden an wissenschaftlichen forschungsprojektbezogenen Arbeiten eine Qualifizierung im Bereich der Forschung und Entwicklung, aber auch im Bereich der Wissenschaft erreicht werden.
- Durch die größtenteils studierenden-individuelle Gestaltung des Studienprogramms auf Basis der beiden Vertiefungsrichtungen Exoprothetik (am Körper) und Endoprothetik (im Körper) werden andererseits Ingenieure und Ingenieurinnen für die Tätigkeit in der freien Wirtschaft ausgebildet.

Im Spannungsfeld des demografischen Wandels mit neuen veränderten Anforderungen wie z.B. Autonomie und Mobilität im Alter und der regenerativen Medizin stehen den Absolventen und Absolventinnen des Masterstudiengangs Biomechanical Engineering besonders aktuelle und nachgefragte Berufsfelder mit hervorragenden Zukunftsperspektiven zur Auswahl

Die Absolventen und Absolventinnen sind befähigt, einerseits leitende und selbständige Tätigkeiten in der Industrie (z.B. folgende Branchen: Medizintechnik, insbesondere Entwicklung, Herstellung und Vertrieb von Medizinprodukten und deren Zuliefer- und Produktionsketten, Zertifizierungsstellen und -behörden, Patentbehörden etc.) sowohl in Anwendung und Dienstleistung als auch in der Forschung auszufüllen. Andererseits sind entsprechende Tätigkeiten in Wissenschaft und Bildungswesen möglich.

Die akademische Ausbildung mit dem Abschluss M.Sc. der Otto-von-Guericke-Universität liefert eine hinreichende Voraussetzung für weitere postgraduale Ausbildungen im Bereich der Ingenieurwissenschaften und angrenzenden Gebieten. (zum Beispiel Promotion).

Educational Results

(social competences):

In the course of their studies, students gain access to existing research foci by an interdisciplinary team project and qualifying papers.

The students are qualified accordingly in order to be able to follow different professional paths after completing the master degree program:

- By the participation of students in scientific research project-related work, a qualification in the field of research and development, but also in the field of science is to be achieved on the one hand
- By the predominantly student-individual design of the study program based on the two specializations exoprosthesis (on the body) and endoprosthesis (in the body), engineers are trained for work in the private sector on the other hand.

With respect to the demographic change and new rising challenges such as autonomy and mobility in senior life and regenerative medicine, graduates of the master degree program Biomechanical Engineering are offered wide occupational fields of recent and popular jobs with great potential.

Graduates are qualified to take on managerial and independent positions in industry (e.g. the following sectors: medical technology, especially development, production and distribution of medical products and their supply and production chains, certification bodies and authorities, patent authorities, etc.) both in application and service as well as in research. On the other hand, corresponding activities in science and education are possible.

The academic education with the degree M.Sc. of the Otto-von-Guericke University provides a sufficient prerequisite for further postgraduate education in the field of engineering and related fields, e.g. doctorate.

Kurzcharakteristik

Die Immatrikulation erfolgt zum Wintersemester. Der Masterstudiengang ist so konzipiert, dass das Studium einschließlich der Anfertigung der Masterarbeit mit Kolloquium in der Regelstudienzeit von vier Semestern abgeschlossen werden kann.

Der Studienaufwand wird mit Leistungspunkten (Credit points [CP]) beschrieben. Er beträgt insgesamt 120 CP, die sich auf den Pflicht-, Spezialisierung- und Wahlpflichtbereich sowie die Masterarbeit verteilen.

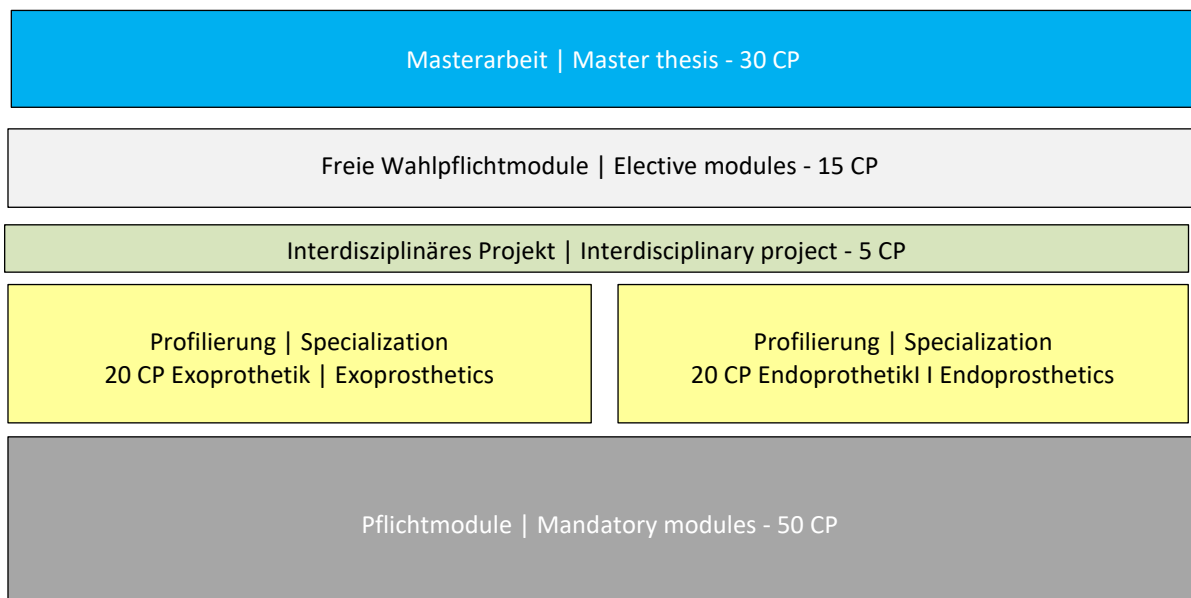
Das Arbeitspensum beträgt ca. 30 CP pro Semester.

Brief Description

Enrolment takes place in the winter semester. The master degree program is designed in such a way that the course of study, including the preparation of the master thesis with colloquium, can be completed in the standard period of study of four semesters.

The study effort is described with credit points (CP). It amounts to a total of 120 CP, which are distributed among the mandatory, specialization and elective areas as well as the master thesis.

The workload is approximately 30 CP per semester.



Prinzipieller Aufbau des Masterprogramms Biomechanical Engineering |
General structure of the master degree program Biomechanical Engineering

Die Abbildung zeigt schematisch den prinzipiellen Aufbau des Masters Biomechanical Engineering, bestehend aus:

- einem Pflichtbereich mit 6 Modulen zu je 5 CP
- der studierendenindividuellen Wahl einer der Profilierungen mit je 4 Modulen zu je 5 CP,
- einem interdisziplinären Projekt zu 5 CP,
- drei freien Wahlpflichtmodulen zu je 5 CP, aus dem dafür verfügbaren breiten Modulangebot
- und der abschließenden Masterarbeit.

Der Profilierungsbereich und der freie Wahlpflichtbereich ermöglichen den Studierenden, individuellen Neigungen und Interessen nachzugehen bzw. fachspezifischen Erfordernissen des späteren Tätigkeitsfeldes Rechnung zu tragen.

The figure shows the schematic structure of the master degree program Biomechanical Engineering, consisting of:

- a mandatory area with 10 modules of 5 CP each
- the student-individual choice of one of the specializations with 4 modules of 5 CP each,
- one interdisciplinary project of 5 CP,
- three elective modules of 5 CP each, from the broad range of modules available for this purpose,
- and the final master thesis.

The specialization area and the elective area enable the students to pursue individual inclinations and interests or to take into account subject-specific requirements of the later field of activity.

Der Pflicht- und Wahlpflichtbereich verteilt sich auf die ersten drei Semester. Das interdisziplinäre Projekt ist als interdisziplinäres Projekt konzipiert und wird empfohlen, im 3. Semester anzuordnen. .

Einige Module werden in der Lehrveranstaltungsart eines erfahrungsorientierten Seminars – einer Lernwerkstatt – angeboten. In diesen herrscht eine Pflicht zur Teilnahme an den angebotenen Lehrveranstaltungen entsprechend der Modulbeschreibung.

Das Studium schließt mit einer Abschlussarbeit, der so genannten Masterarbeit und deren Präsentation in einem Kolloquium ab. Die Abschlussarbeit soll zeigen, dass die Studierenden in der Lage sind, innerhalb einer vorgegebenen Bearbeitungszeit eine Problemstellung selbstständig, wissenschaftlich und kompetent zu bearbeiten

The mandatory and elective areas are distributed over the first three semesters. The interdisciplinary project is designed as an interdisciplinary project and is recommended to be arranged within the 3rd semester.

Some modules are offered in the form of an experience-oriented seminar – a learning lab. In these, participation in the courses offered is compulsory in accordance with the module description.

The program concludes with a final thesis, the master thesis, and its presentation in a scientific colloquium. The thesis should show that the students are able to work on a problem independently, scientifically and professionally within a given period of time.

2 Geltung des Modulhandbuchs | Validity of the module handbook

Das vorliegende Modulhandbuch gilt für Studierende, deren Studium sich nach der studienangangspezifischen Studien- und Prüfungsordnung (sSPO) für den Masterstudiengang Biomechanical Engineering, veröffentlicht als amtliche Bekanntmachung 02/2024, geändert durch die erste Satzung zur Änderung der sSPO, veröffentlicht als amtliche Bekanntmachung 04/2025, zuletzt geändert durch die zweite Satzung zur Änderung der sSPO, veröffentlicht als amtliche Bekanntmachung 32/2026, richtet.

Bitte beachten Sie die Allgemeine Regelungen betreffend die Organisation und Durchführung von Studienangeboten an der OVGU Magdeburg ([AROSTA-2026](#)). Diese Ordnung regelt studien- und prüfungsrelevante Sachverhalte sowohl für Bachelor- und Masterstudiengänge der Otto-von-Guericke-Universität Magdeburg (OVGU) als auch für andere Studienangebote und findet Anwendung ab dem Wintersemester 2026/27 auf alle an der OVGU immatrikulierten Studierenden. Soweit in aSPO bzw. in der sSPO Bestimmungen enthalten sind, die von den Regelungen der AROStA abweichen, gelten die Bestimmungen der AROStA, außer in den Fällen, in denen die aSPO bzw. die sSPO eine Abweichung von der AROStA ausdrücklich vorsieht.

This module handbook applies to students whose studies are based on the study and program-specific study and examination regulations (sSPO) for the Master's degree course in Biomechanical Engineering, published in Germany under "Amtliche Bekanntmachung Nr. 02/2024", amended by the first statutes amending the sSPO, published in Germany under "Amtliche Bekanntmachung Nr. 04/2025", last amended by the second statutes amending the sSPO, published in Germany under "Amtliche Bekanntmachung Nr. 32/2026".

Please observe the General Regulations concerning the Organization and Administration of Study Programs OVGU Magdeburg ([AROSTA-2026](#)). These regulations govern matters relating to academic studies and examinations for Bachelor's and Master's degree programs at Otto von Guericke University Magdeburg (OVGU), as well as for other study programs, and apply to all students enrolled at OVGU beginning with the Winter Semester 2026/27. Where the General Study and Examination Regulations (aSPO) or the Program-Specific Study and Examination Regulations (sSPO) contain provisions that differ from those of AROStA, the provisions of AROStA shall prevail, except where the aSPO or sSPO expressly permit deviations.

3 Pflichtbereich | Mandatory area

Die Module des Pflichtbereichs spannen den weiten Bogen und den Facettenreichtum des Biomechanical Engineering auf und bilden den Rahmen für die möglichen Spezialisierungen. Die Module liegen in den ersten 3 Semestern des Fachstudiums und sind von allen Studierenden zu absolvieren.

The modules of the mandatory area cover the broad spectrum and the many facets of biomechanical engineering and provide the context for the possible specializations. The modules are situated in the first 3 semesters of the study program and have to be completed by all students.

Regelstudienplan allgemein | General study plan

Masterstudiengang Master degree program		CP	V Ü P [SWS]	1. Sem	2. Sem	3. Sem	4. Sem
Biomechanical Engineering				WiSe	SoSe	WiSe	SoSe
Pflichtbereich Mandatory area							
Anatomy for Engineering Students		5	3 - -	S, K90			
Biomechanical Sensors		5	2 2 -	K120			
Orthopedic Technology *		5	2 1 -	K120			
Applied Biomechanics		5	2 2 -	K120			
Applied Engineering Design		5	2 1 -	S, K120			
Biomedical Materials I		5	2 1 -	K90			
Biomedical Materials II		5	2 1 -		K90		
Clinical Biomechanics *		5	2 1 -		S, K120		
Medical Device Regulation and Ethics in Medicine		10					
Part I: Introduction to the approval process of medical devices		(5)	2 1 -		**	K90	
Part II: History and Ethics of Medicine and Medical Engineering		(5)	2 2 -			K90	
Profilierungsbereich Specialization area							
Specialization Exoprosthetics	Modul 1	5			P		
	Modul 2	5			P		
	Modul 3	5				P	
	Modul 4	5				P	
Specialization Endoprosthetics	Modul 1	5			P		
	Modul 2	5				P	
	Modul 3	5				P	
	Modul 4	5				P	
Wahlpflichtbereich Elective area							
Modul 1		5			P		
Modul 2		5			P _{Endo}	P _{Exo}	
Modul 3		5				P	
Projektbereich Project area							
Interdisciplinary Project		5	- 3 -			W	
Masterarbeit mit Kolloquium Master thesis with colloquium		30		30			W
Summe in CP je Semester Total in CP per semester					30 ** 25	30 ** 35	30

Legende Prüfungsformen | Legend Forms of examination:

K – Klausur (angegebene Dauer in Minuten) | written exam (duration in minutes),
R – Referat | oral presentation,
S – Seminar– / Hausarbeit | homework, term paper
W – Wissenschaftliches Projekt | scientific project
V|Ü|P – Vorlesung|Übung|Praktikum | Lecture|Exercise|Practical course

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.

As per §14 (11) of the General Study and Examination Regulations, for each module the module coordinator may specify pre-examination requirements that are necessary pre-conditions for the awarding of CP

* Es besteht Pflicht zur Teilnahme an den Lehrveranstaltungen entsprechend Modulbeschreibung.

* Participation in the courses according to the module description is compulsory

** entsprechend Beschluss des Prüfungsausschusses vom 2026-02-25: Verschiebung des Moduls ins Wintersemester 2026-27 sowie der zweiten Satzung zur Änderung der sSPO, veröffentlicht als amtliche Bekanntmachung 32/2026

** In accordance with the decision of the examination board dated 2026-02-25: Postponement of the module to the winter semester 2026-27 as well as the second statute amending the sSPO, published as official announcement 32/2026

4 Profilierung / Spezialisierung | Profiling / Specialization

Ihre Vertiefungsrichtungswahl findet nach dem ersten Semester statt. Sie erfolgt über eine LSF Einschreibung in den Kurs "Registration for the specialization in the BiME degree program". Die Platzanzahl ist entsprechend limitiert, bitte tragen Sie sich nur für eine Vertiefungsrichtung ein.

You choose your specialization after the first semester. It takes place via LSF enrolment in the course "Registration for the specialization in the BiME degree program". The number of places is accordingly limited, please only register for one specialization..

4.1 Profilierung Exoprothetik | Specialization Exoprosthetics

Die Exoprothetik beschäftigt sich mit medizinische Assistenzsysteme, also Unterstützungssystemen am Körper. Dazu zählen neben orthopädischen Hilfsmitteln, die als Körperersatzstücke fungieren, auch am menschlichen Körper getragene mechanische Strukturen, sogenannte Orthesen, die die Bewegungen des Trägers unterstützen, verstärken oder erleichtern können. Der Ersatz von Gliedmaßen mit einer vollständigen oder teilweisen Wiederherstellung der ursprünglichen Funktionalitäten wie z.B. künstliche Hände mit nahezu vollständiger mechanischer Funktionalität oder Unterschenkelprothesen im Leistungssport, sind ebenfalls Bestandteile der Exoprothetik.

Studierende, die sich im Studiengang Biomechanical Engineering in Richtung der Exoprothetik spezialisieren, können unter anderem folgende Kompetenzen erlangen:

- vertiefende Kenntnis biomechanischer Bewegungsabläufe sowie deren Analyse und Modellierung/ Simulation
- Fähigkeit zur Ableitung von Voraussetzungen, Randbedingungen und Anforderungen, welche Exoprothesen im Anwendungsfall erfüllen müssen und Übertragung dieser in einen Produktentwicklungsprozess
- Konzipierung, Auslegung/Dimensionierung und Gestaltung von anforderungsgerechten medizinischen Assistenzsystemen unter Berücksichtigung aller zusammentreffenden Komponenten (biologisch, mechanisch, medizinisch, elektronisch, ...)

Mit diesen Kompetenzen können die Absolventen und Absolventinnen im Berufsleben in Branchen der Medizintechnik und Ingenieurwissenschaften darunter insbesondere in Bereichen der Entwicklung, Herstellung und dem Vertrieb und Zertifizierung von Medizinprodukten anspruchsvolle und vielseitige Tätigkeiten ausüben.

The specialization in Exoprosthetics deals with medical assistance systems, i.e. supportive products for the human body. In addition to orthopedic aids that function as body substitutes, this also includes mechanical structures worn on the human body, so-called orthoses, which can support, reinforce or facilitate the movements of the person wearing them. The replacement of limbs with a complete or partial restoration of the original functionality, such as artificial hands with almost complete mechanical functionality or lower leg prostheses in competitive sports, are also part of exoprosthetics.

Students of the master program Biomechanical Engineering that specialize in Exoprosthetics can acquire the following competences, among others:

- in-depth knowledge of biomechanical movement processes and their analysis and modeling/ simulation
- skills to derive prerequisites, boundary conditions and requirements that exoprostheses must fulfill in the application and transfer these to a product development process
- Conceptualization, layout/dimensioning and design of medical assistance systems according to requirements considering all coinciding components and interfaces involved (biological, mechanical, medical, electronic, ...).

With these competences, the graduates will be able to perform challenging and versatile tasks and activities in their professional careers in the field of medical technology and engineering sectors, including in particular the areas of development, manufacturing, sales and quality management, such as certification of medical devices.

Die wesentlichen Einsatzmöglichkeiten liegen in den Aufgabenbereichen Forschung, Vorentwicklung, Entwicklung, Versuch, Projektierung, Konstruktion, Inbetriebnahme, Service und Berechnung und Auslegung von medizinischen Assistenzsystemen. Neben den vielfältigen Beschäftigungsmöglichkeiten in der Industrie sind auch bei Dienstleistern, wie z.B. TÜV oder anderen Prüfinstituten und Behörden und bei öffentlichen Forschungseinrichtungen (z.B. Fraunhofer- und Max-Planck-Institute) und Hochschulen interessante Tätigkeitsfelder zu finden.

Main employment opportunities comprise the working fields of research, pre-development, development, testing, project planning, construction, commission, service, simulation and design of medical assistance systems. In addition to many employment opportunities in industry, interesting fields of activity can also be found at service providers, such as TÜV or other testing institutes and authorities, and at public research institutions (e.g. Fraunhofer and Max Planck Institutes) and universities.

Legende Prüfungsformen | Legend Forms of examination:

K – Klausur (angegebene Dauer in Minuten) | written exam (duration in minutes),

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W – Wissenschaftliches Projekt | scientific project

V|Ü|P – Vorlesung|Übung|Praktikum | Lecture|Exercise|Practical course

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.

As per §14 (11) of the General Study and Examination Regulations, for each module the module coordinator may specify pre-examination requirements that are necessary pre-conditions for the awarding of CP

* Es besteht Pflicht zur Teilnahme an den Lehrveranstaltungen entsprechend Modulbeschreibung.

* Participation in the courses according to the module description is compulsory

** entsprechend Beschluss des Prüfungsausschusses vom 2026-02-25: Verschiebung des Moduls ins Wintersemester 2026-27 sowie der zweiten Satzung zur Änderung der sSPO, veröffentlicht als amtliche Bekanntmachung 32/2026

** In accordance with the decision of the examination board dated 2026-02-25: Postponement of the module to the winter semester 2026-27 as well as the second statute amending the sSPO, published as official announcement 32/2026

Moduleinordnung in den Studienablauf in der Profilierung „Exoprothetik“ |

Module integration into the course of study within the "Exoprosthetics" specialization

Masterstudiengang Master degree program		CP	V Ü P [SWS]	1. Sem	2. Sem	3. Sem	4. Sem
Biomechanical Engineering				WiSe	SoSe	WiSe	SoSe
Pflichtbereich Mandatory area							
Anatomy for Engineering Students		5	3 - -	S, K90			
Biomechanical Sensors		5	2 2 -	K120			
Orthopedic Technology *		5	2 1 -	K120			
Applied Biomechanics		5	2 2 -	K120			
Applied Engineering Design		5	2 1 -	S, K120			
Biomedical Materials I		5	2 1 -	K90			
Biomedical Materials II		5	2 1 -		K90		
Clinical Biomechanics *		5	2 1 -		S, K120		
Medical Device Regulation and Ethics in Medicine		10					
Part I: Introduction to the approval process of medical devices		(5)	2 1 -		**	K90	
Part II: History and Ethics of Medicine and Medical Engineering		(5)	2 2 -			K90	
Profilierungsbereich Specialization area							
Specialization Exoprosthetics	Design of Mechatronic Systems	5	- 3 -		K90		
	Dynamics of Motion	5	2 2 -		K120		
	Motion Analysis	5	2 1 -			K120	
	Product Design and Drafting	5	2 2 -			K120	
Wahlpflichtbereich Elective area							
Modul 1		5			P		
Modul 2		5				P	
Modul 3		5				P	
Projektbereich Project area							
Interdisciplinary Project		5	- 3 -			W	
Masterarbeit mit Kolloquium Master thesis with colloquium		30					W
Summe in CP je Semester Total in CP per semester				30	30 ** 25	30 ** 35	30

4.2 Profilierung Endoprothetik | Specialization Endoprosthetics

Endoprothetik beschäftigt sich mit verschiedenen Formen von Implantaten, d. h. Medizinprodukten, welche möglichst dauerhaft im Körper verbleiben und die Funktion der zu ersetzenden Komponente (Gelenk) vollständig übernehmen oder unterstützen. Dazu zählen insbesondere künstliche Knie-, Schulter- und Hüftendoprothesen.

Studierende, die sich im Studiengang Biomechanical Engineering in Richtung der Endoprothetik spezialisieren, können unter anderem folgende Kompetenzen erlangen:

vertiefende Kenntnisse über positive und negative Wechselwirkungen zwischen Implantaten, insbesondere der verschiedenen Werkstoffe, und menschlichem Gewebe

Verständnis der im Körper ablaufenden chemischen bzw. biologischen Reaktionen, welche bei Nutzung von Implantaten eine wichtige Bedeutung haben

Erlernung der Fähigkeiten zur Auslegung, Auswahl und Überwachung (mit bildgebenden Verfahren) von anforderungsgerechten Implantaten

Mit den Kompetenzen können die Absolventen und Absolventinnen im Berufsleben in Branchen der Medizintechnik und Ingenieurwissenschaften darunter insbesondere in Bereichen der Entwicklung, Herstellung und Optimierung von Implantaten anspruchsvolle und vielseitige Tätigkeiten ausüben.

Die wesentlichen Einsatzmöglichkeiten liegen in den Aufgabenbereichen Forschung, Vorentwicklung, Entwicklung, Versuch, Projektierung, Konstruktion, Inbetriebnahme, Service und Berechnung, Auslegung und Überwachung von Medizinprodukten für den Gebrauch im menschlichen Körper. Neben den vielfältigen Beschäftigungsmöglichkeiten in der Industrie sind auch bei Dienstleistern, wie z.B. TÜV oder anderen staatlichen und unabhängigen Prüfinstituten, in Zertifizierungs- und Zulassungsbehörden und bei öffentlichen Forschungseinrichtungen (z.B. Fraunhofer- und Max-Planck-Institute) und Hochschulen interessante Tätigkeitsfelder zu finden, worunter auch gutachterliche Tätigkeiten im freiberuflichen oder Angestelltenverhältnis fallen.

Endoprosthetics deals with various forms of implants, which are medical devices that remain in the body as permanently as possible and completely take over or support the function of the component (joint) to be replaced. These include in particular artificial knee, shoulder and hip endoprostheses.

Students of the master program Biomechanical Engineering that specialize in Endoprosthetics can acquire the following competences, among others:

- in-depth knowledge of positive and negative interactions between implants, especially the various materials, and human tissue
- Understanding of the chemical and biological reaction and processes place in the human body, which are relevant for the application of implants
- Learn the skills to design, select and monitor (with imaging techniques) implants that meet the requirements

With these competences, the graduates will be able to perform demanding and versatile activities in their professional life in the medical technology and engineering sectors, especially in the areas of development, production and optimization of implants.

Main employment opportunities comprise the working fields of research, pre-development, development, testing, project planning, construction, commission, service, simulation, quality management/ monitoring of medical devices for use in the human body.

In addition to the wide range of employment opportunities in industry, interesting fields of activity can also be found at service providers, such as TÜV or other state and independent testing institutes, in certification and licensing authorities and at public research institutes (e.g. Fraunhofer and Max Planck Institutes) and universities, which also include expert activities on a freelance or salaried basis.

Legende Prüfungsformen | Legend Forms of examination:

K – Klausur (angegebene Dauer in Minuten) | written exam (duration in minutes),

R – Referat | oral presentation,

S – Seminar- / Hausarbeit | homework, term paper

W – Wissenschaftliches Projekt | scientific project

V|Ü|P – Vorlesung|Übung|Praktikum | Lecture|Exercise|Practical course

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.

As per §14 (11) of the General Study and Examination Regulations, for each module the module coordinator may specify pre-examination requirements that are necessary pre-conditions for the awarding of CP

* Es besteht Pflicht zur Teilnahme an den Lehrveranstaltungen entsprechend Modulbeschreibung.

* Participation in the courses according to the module description is compulsory

** entsprechend Beschluss des Prüfungsausschusses vom 2026-02-25: Verschiebung des Moduls ins Wintersemester 2026-27 sowie der zweiten Satzung zur Änderung der sSPO, veröffentlicht als amtliche Bekanntmachung 32/2026

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Moduleinordnung in den Studienablauf in der Profilierung „Endoprothetik“|

Module integration into the course of study within the "Endoprosthesis" specialization

Masterstudiengang Master degree program		CP	V Ü P [SWS]	1. Sem	2. Sem	3. Sem	4. Sem
Biomechanical Engineering				WiSe	SoSe	WiSe	SoSe
Pflichtbereich Mandatory area							
Anatomy for Engineering Students		5	3 - -	S, K90			
Biomechanical Sensors		5	2 2 -	K120			
Orthopedic Technology *		5	2 1 -	K120			
Applied Biomechanics		5	2 2 -	K120			
Applied Engineering Design		5	2 1 -	S, K120			
Biomedical Materials I		5	2 1 -	K90			
Biomedical Materials II		5	2 1 -		K90		
Clinical Biomechanics *		5	2 1 -		S, K120		
Medical Device Regulation and Ethics in Medicine		10					
Part I: Introduction to the approval process of medical devices		(5)	2 1 -		**	K90	
Part II: History and Ethics of Medicine and Medical Engineering		(5)	2 2 -			K90	
Profilierungsbereich Specialization area							
Specialization Endoprosthesis	Biotribological Systems	5	2 - -		K90		
	Imaging and Visualization in Biomedical Engineering	5	2 1 -			K120	
	Biochemistry/Biomedicine	5	2 1 -			K120	
	Introduction in Tissue Engineering	5	2 2 -			K90	
Wahlpflichtbereich Elective area							
Modul 1		5			P		
Modul 2		5			P		
Modul 3		5				P	
Projektbereich Project area							
Interdisciplinary Project		5	- 3 -			W	
Masterarbeit mit Kolloquium Master thesis with colloquium		30					W
Summe in CP je Semester Total in CP per semester				30	30 ** 25	30 ** 35	30

5 Freier Wahlpflichtbereich | Elective area

Der freie Wahlpflichtbereich ermöglicht es den Studierenden, individuellen Neigungen und Interessen nachzugehen bzw. fachspezifischen Erfordernissen des späteren Tätigkeitsfeldes Rechnung zu tragen. Im freien Wahlpflichtbereich sind Module im Umfang von mindestens 15 CP aus dem Modulangebot zu belegen und zur Notenberechnung einzubringen. Jedes Modul muss mindestens einen Umfang von 5 CP umfassen. Zu dem Modulangebot zählen alle Module der nicht gewählten Spezialisierungsrichtung, die Module aus der nachstehenden Auflistung sowie maximal ein Modul aus dem Modulangebot der OvGU.

The elective area enables students to pursue individual inclinations and interests or to take into account subject-specific requirements of the later field of activity. In the elective area, modules with an amount of at least 15 CP from the range of modules must be completed and incorporated into the final grade calculation. Each module must have a minimum of 5 CP. The range of modules includes all modules of the non-selected specialisation, the modules from the following list as well as a maximum of one module from the complete range of modules offered by the OvGU.

Liste von weiteren freien Wahlpflichtmodulen | List of possible elective courses

Categories	CP	Winter semester				Summer semester			
		V	Ü	P	PL	V	Ü	P	PL
Business Decision Making	5	2	1		K60				
Computational Biomechanics	5	2	2		M				
Design, Additive Manufacturing and Powder Requirements	5	2	2		K90				
Marketing Performance Management	5	2	2		K60	2	2		K60
Basics of Immunology (in German)	5					2		2	K120
Biomechanics in Sports	5					1	2		W
Introduction to Medical Science in Space	5					2	2		K90
Material Modeling	5					2	1		M
Medical Technology from a Company Perspective	5					2			R/B
Materials Science	5					2	1		K90
Microscopic Methods	5					2		1	K90

Legende Prüfungsformen | Legend Forms of examination:

- V – Vorlesung | Lecture,
- Ü – Übung | Exercise,
- P – Praktikum | Practical course,
- PL – Prüfungsleistung | Forms of examination,
- K – Klausur (angegebene Dauer in Minuten) | written exam (duration in minutes),
- M – Mündliche Prüfung | oral examination
- R – Referat | oral presentation,
- Pofo – Portfolioprüfung | portfolio exam
- B – Belegarbeit | coursework

6 Allgemeine Hinweise | General Notes

6.1 An- und Abmeldung von studienbegleitenden Prüfungsleistungen |

Registration and deregistration for study program related exams

Fakultätsübergreifend vereinheitlichen die Allgemeinen Regelungen betreffend die Organisation und Durchführung von Studienangeboten an der OVGU ([AROSTA-2026](#)) über die Änderung und Ergänzung der Studien- und Prüfungsordnungen an der Otto-von-Guericke-Universität Magdeburg die

Anmeldung zu Modulprüfungen auf die Zeiträume

15.11.-30.11. für Prüfungen im Wintersemester bzw.

15.05.-31.05. für Prüfungen im Sommersemester.

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.

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.

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.

The General Regulations concerning the Organization and Administration of Study Programs at Otto von Guericke University Magdeburg ([AROSTA-2026](#)) which amend and supplement the Study and Examination Regulations, establish uniform rules for module examination registration across all faculties.

Registration for module examinations is limited to the following periods

15.11.-30.11. for examinations in the Winter Semester and

15.05.-31.05. for examinations in the Summer Semester.

For examinations scheduled after these registration periods and for repeat examinations within the same semester, the Examination Office responsible for the module establishes a two-week admission and registration period. Such examinations are open to all students.

Withdrawal: Registration for an examination can be withdrawn no later than 3 calendar days before the scheduled examination date. If the registration is withdrawn, admission must be requested again for at a later examination date.

In the event of illness, a medical certificate (see download area "Forms" under fmb:intern) must be submitted. If illness prevents the medical certificate from being submitted on time, the responsible Examination Office must be notified in writing or by email no later than the day of the examination. In this case, the medical certificate must be submitted to the responsible Examination Office within three working days after the physician has certified the illness. Any exceptions are decided by the responsible Examination Board.

7 Modulbeschreibungen | Module descriptions

7.1 Anatomy for Engineering Students

Course name	Anatomy for Engineering Students ^{1*}	Exam number: 606578
German title	Grundlagen der Anatomie und Physiologie	
Teaching aims and content of the module	Teaching aims and competences to be gained: • students acquire basic knowledge of anatomy and physiology of the central and peripheral nervous system • students acquire basic knowledge of anatomy and physiology of the locomotion system • students acquire basic knowledge of anatomy and physiology of the cardio-vascular system • students apply knowledge on biomechanical properties of the structures/ organs discussed in a problem-based approach • students apply knowledge on consequences and requirements for medical devices and implants in a problem-based approach	
	Contents: • microscopic and macroscopic structures and functions of human nervous system, musculoskeletal system and cardiovascular system • literature search on biomechanical properties and functionality of the discussed structures, and application in biomedical engineering • coursework, e.g., on properties of skeletal and smooth muscles, properties of joint structures (bone, tendon, cartilage), proprioception, movement regulation	
Type of lecture	Seminar	
Literature	Anatomy and physiology books and atlases, original research articles, reviews, PubMed, open E-learning source	
Preconditions for attending	none	
Usability of the module	according to module handbook	
Prerequisites for the provision of ECTS	The timely submission of the marked coursework is prerequisite for the examination. Final grading will consist of: 100% marked multiple-choice exam (K90)	
ECTS and marks	5 CP grading according to the study and examination regulations	
Efforts	3 hours per week seminar	
Frequency of provision	every winter term	
Duration of module	1 semester	
Responsible lecturer	Prof. Dr. med. Christoph Lohmann, FME-KORT	

1*) The module will be mentioned in the planning of the lectures as "Anatomy for Engineering Students (BiME)".

7.2 Applied Biomechanics

Course name	Applied Biomechanics	Exam number: 606581
German title	Angewandte Biomechanik	
Teaching aims and content of the module	• Detailed knowledge concerning deformation mechanisms in solid materials • Understanding to formulate concrete boundary and initial value problems out of continuum mechanics • Detailed knowledge concerning kinematics and kinetics of motion • Knowledge concerning different solution methods for static and dynamical systems • Comprehensive understanding concerning vibration problems in biomechanical systems • Understanding of the general spatial dynamics of rigid biomechanical systems	
	Contents: • Fundamentals of continuum mechanics • Fundamental balance laws • Constitutive equations for soft (e.g. tissue) and hard (e.g. bone) materials • Kinematics and kinetics of linear and angular motion • Force and energy based mechanical methods for describing dynamical systems • Basics of vibration dynamics (oscillator with 1 and 2 degrees of freedom) • Introduction of harmonic, modal and transient analyses • Coordinate systems and spatial orientation • Basics of spatial dynamics with focus on gyroscopic effects	
Type of lecture	Lectures; Seminars	
Literature	will be offered in the first lecture	
Preconditions for attending	recommended: knowledge of engineering mechanics (statics, basics of strength theory and dynamics)	
Usability of the module	according to module handbook	
Prerequisites for the provision of ECTS	examination: written examination (K120)	
ECTS and marks	5 CP grading according to the examination regulations	
Efforts	2 hours per week lecture, 2 hours per week exercises, Self-Study: Individual semester assignment that is included in the examination grade	
Frequency of provision	every winter term	
Duration of module	1 semester	
Responsible lecturer	Prof. Dr.–Ing. Daniel Juhre, FMB Prof. Dr.–Ing. Elmar Woschke, FMB apl. Prof. Dr.–Ing. habil. Konstantin Naumenko, FMB	

7.3 Applied Engineering Design

Course name	Applied Engineering Design	Exam number: 601396
German title	Angewandte Konstruktionstechnik	
Teaching aims and content of the module	Teaching aims and competences to be gained: The aim of this course is the systematic development, calculation, and design of products. The course provides a systematic approach to product development, covering the entire process from idea generation to the final product. Students will acquire the methodological skills necessary for conceptualizing and comprehensively understanding complex technical systems. The theoretical content presented in the lectures is reinforced through practical exercises and an interdisciplinary Engineering Design group project. By working on this group project, students gain valuable hands-on experience and develop essential competencies for collaboration in interdisciplinary development teams. The group project is thematically aligned with the specific study program. The topics are defined according to the academic focus of the respective study program. The project groups are formed within the respective study program.	
	Contents: • Introduction • Methodical design – a systematic approach • Design problem definition • Fundamentals of creative thinking • Generation of alternative solutions • Fundamentals of technical systems and consequences for the design process • Product planning and clarification of the task • Listing the functional requirements and constraints • Establishing function structures • Methods to search for solution principles to fulfill the functions • Selecting suitable combinations of solution principles • Evaluating concept variants • Basic rules of Engineering Design • Principles of embodiment design • Design guidelines • Design exercises and an Engineering Design group project • Development of leadership and teamwork skills through co-operative tasks and project work	
Type of lecture language	Lectures; Seminars	English
Literature	Engineering Design: A Systematic Approach / by Gerhard Pahl, Wolfgang Beitz, Jörg Feldhusen, Karl-Heinrich Grote; edited by Ken Wallace, Lucienne Blessing, 3rd edition, London: Springer-Verlag London Limited, 2007. – 978-1-84628-319-2, 978-1-84628-318-5 (print-book)	
Preconditions for attending	none	
Usability of the module	according to module handbook	
Prerequisites for the provision of ECTS	The final grade of the course is made up of two examinations: • 50% written exam (120 min) • 50% engineering design group project The design project is carried out in groups over the entire semester. At the	

	end of the semester, a group report must be submitted by each group. In addition, the group project must be presented by the group members in a presentation. Important: The conditions of the group project MUST be fulfilled to be admitted to the written exam! Only a complete group project (report + presentation) can be recognized as an examination achievement and remains valid for a repeated written exam. Handwritten notes (1 sheet) are permitted for the written exam. Each examination must be completed and passed to pass the course.
ECTS and marks	5 CP grading according to the examination regulations
Efforts	2 hours per week lecture, 1 hour per week exercises, 119 hours self-study
Frequency of provision	Each winter term
Duration of module	One semester
Responsible lecturer	Dr.-Ing. Stephan Trautsch, FMB

7.4 Basics of Immunology

The lecture is held in German.

Course name	Basics of Immunology ^{2*}	Exam number: 700011
German title	Grundlagen der Immunologie	
Teaching aims and content of the module	Teaching aims and competences to be gained: Students will be able to describe and evaluate specific features and systematic problems of immunology. In the practical course, students will acquire the capability to confidently apply specific working techniques of the field.	
	Contents: • Introduction to Immunology • Immune Organs • Immune Cells • Immune Mechanisms • Immunity Link to the course structure: http://imki.med.ovgu.de/Lehre/Biosystemtechnik.html	
Type of lecture	Lectures, Practical Course	
Literature	• G.R Burmester, A. Pezzuto, T. Ulrichs: Taschenatlas der Immunologie (Thieme Verlag) • K. Murphy, P. Travers, M. Walport: Janeway Immunologie (Spektrum Akademischer Verlag) • J. Abbas, A. H. Lichtmann: Basic Immunology (Saunders Elsevier Verlag)	
Preconditions for attending	none	
Usability of the module	according to module handbook	
Prerequisites for the provision of ECTS	written examination (K120); successful participation in the practical courses including the lab reports	
ECTS and marks	5 CP grading according to the examination regulations	
Efforts	2 hours per week (2 SWS) lecture, 2 hours per week (2 SWS) practical course, 94 h self-study	
Frequency of provision	every summer term; the practical course is limited to a maximum of 5 students	
Duration of module	1 semester	
Responsible lecturer	Prof. Dr. biol. hum. Luca Simeoni, FME-IMKI	

2*) The module will be mentioned in the planning of the lectures as “Immunologie”.

7.5 Biochemistry/ Biomedicine

Course name	Biochemistry/ Biomedicine	Exam number: 604379
German title	Biochemie/ Biomedizin	
Teaching aims and content of the module	Teaching aims and competences to be gained: Students learn the necessary basics of biological processes of the joint cells and the extracellular matrix in order to understand the physiological processes of the healthy joint. In the further course, students are taught the pathophysiological processes of the joint (osteoarthritis, fracture healing, rheumatic diseases, osteomalacia, etc.) and the underlying mechanisms are explained based on the current state of science. The, to date, possibilities to engineer viable cartilage will be taught. Based on the understanding of the physiological processes of the healthy joint, the basics of biotribology and biomechanics are finally taught, which enables the students to evaluate the involved influencing factors of orthopaedically relevant diseases of the joint based on the basic knowledge of medicine, biology, mechanics and tribology. In the accompanying seminar, various test setups, ISO standards and basic skills for the independent development of new approaches (statistics, experimental design, influencing factors, etc.) are taught.	
	Contents: Introduction to relevant biomedical cellular processes: • Cell and Metabolism: Molecular biology and biochemistry of genes, cell biology, gene regulation and metabolism. • Basics of extracellular matrix • Basics mechanosensing • Basics immunology and inflammation • Infections and pathogens	
Type of lecture	Lectures; Seminars	
Literature		
Preconditions for attending	none	
Usability of the module	according to module handbook	
Prerequisites for the provision of ECTS	final grading consists of 30 % marked coursework (presentation) and 70 % written examination (K120)	
ECTS and marks	5 CP grading according to the examination regulations	
Efforts	2 hours per week lecture, 1 hours per week exercises, self-study	
Frequency of provision	every winter term	
Duration of module	1 semester	
Responsible lecturer	Prof. Dr. rer.nat. Jessica Bertrand, FME-KORT Dr. rer. medic. Sascha Kopp, FCST-ICH Dr. rer. nat. Marcus Krüger, FME-MTRM	

7.6 Biomechanical Sensors

Course name	Biomechanical Sensors	Exam number: 606579
German title	Biomechanische Sensoren	
Teaching aims and content of the module	Teaching aims and competences to be gained: Biomechanical sensors are a key technology that enables the measurement of mechanical parameters such as force, pressure, strain, or motion in living organisms and converts them into electrical signals. These sensors play a crucial role in fields such as medical technology, sports science, robotics, and rehabilitation, as they provide precise information about biomechanical processes that can be used for diagnosis, monitoring, and therapy. Developing such sensors requires a solid understanding of physics, mechanics, and electronics, as they are based on various physical principles. This lecture will highlight the fundamentals and advances in the development and application of biomechanical sensors at the component level and in (wearable) biomechanical systems. Students will learn the technological fundamentals of sensor systems, measurement techniques, and signal processing and discuss their applicability in various application scenarios. The course content is practice-oriented and includes the use of modern simulation tools such as MATLAB to analyse and evaluate biomechanical data in the exercises. After successful completing the "Biomechanical Sensors" course, students will gain a solid understanding of measurement techniques, sensor technologies, and signal processing, particularly focused on biomechanical systems. They will be capable of analysing, designing, and optimizing sensor systems, using MATLAB for calculations and data analysis to addressing real-world engineering challenges. This course provides both the theoretical insights and practical experience needed for careers in fields such as medical technology, sports science, and robotics.	
	Contents will include: • EMG • Neurosensors • Piezoelectric sensors • Pressure sensors • Tactile sensors • Displacement sensors • IMU • Optical sensors • Textile-based & smartphone-based sensors	
Type of lecture	Lectures; Seminars	
Literature		
Preconditions for attending	none	
Usability of the module	according to module handbook	
Prerequisites for the provision of ECTS	Admission requirement for the exam will be announced in the first lectures. Examination: Written Exam (K120)	
ECTS and marks	5 CP grading according to the examination regulations	
Efforts	2 hours per week lecture, 2 hours per week exercises, autonomous work: Post processing of lectures and exercises, preparation of exam	
Frequency of provision	every winter term	
Duration of module	1 semester	
Responsible lecturer	Prof. Dr.-Ing. Ulrike Steinmann, FEIT-IFAT	

7.7 Biomechanics in Sports

Course name	Biomechanics in Sports	Exam number
German title	Sportbiomechnik	601434
Teaching aims and content of the module	Teaching aims and competencies to be gained: • Students acquire basic knowledge of sports biomechanics • Students acquire basic knowledge of the human musculoskeletal system • Students acquire basic knowledge of kinematics and dynamics • Students apply knowledge on sports movements • Students explore various biomechanical examination methods • Students acquire basic knowledge of sports equipment Contents: • Anthropometry and centre of gravity • Passive and active components of the musculoskeletal system • Kinematics of throwing and impact movements • Biomechanical Principles • Biomechanical performance diagnostics • Biomechanical modeling • Biomechanics in selected sports • Development and optimization of sports equipment	
Type of lecture language	Lectures, Exercises	English
Literature	See lecture handout	
Preconditions for attending	none	
Usability of the module	according to module handbook	
Prerequisites for the provision of credit points	Examination: Scientific project (Final presentation as part of the project work, Both grades count equally towards the overall grade.)	
credit points and marks	5 CP Grading according to the examination regulations	
Workload	Attendance and presence times: 1 x SWS lectures, 2 x SWS exercises Self-study: pre- and post-preparation of lectures and exercises, study of literature, execution of exercises	
Frequency of provision	every summer term	
Duration of module	1 semester	
Responsible lecturer	Prof. Witte, FHW Additional lecturer: Dan Bürger, FHW	

7.8 Biomedical Materials I

Course name	Biomedical Materials I	Exam number: 601426
German title	Werkstoffe in der Medizintechnik I	
Teaching aims and content of the module	Teaching aims and competences to be gained: The students – will obtain an overview of metallic materials that are commonly used as materials for endoprosthetic, exoprosthetic and biomechanical applications – will learn the basics of how to relate the specific properties of materials, which are based on their atomic structure, microstructure, etc., to the requirements of biomedical applications – will be able to correlate the requirements of different biomedical applications (orthopedic, cardiological, dental, etc.) with commonly used materials Contents: – metallic materials: steels, Ti-based, Co-based and Mg-based alloys, further elements and alloys (Ag, Au, Cu) – atomic structure, microstructure, processing and alloying strategy, corrosion properties, mechanical properties, biocompatibility, wear and fatigue – dental applications, orthopedic applications, cardiological applications, applications in otolaryngology	
Type of lecture	lectures; seminars	
Literature	will be given in the lectures	
Preconditions for attending	recommended: materials science basic knowledge	
Usability of the module	according to module handbook	
Prerequisites for the provision of ECTS	written examination (K90)	
ECTS and marks	5 CP grading according to the examination regulations	
Efforts	2 hours per week lecture, 1 hours per week exercises, self-study	
Frequency of provision	every winter term	
Duration of module	1 semester	
Responsible lecturers	Prof. Dr.–Ing. habil. Thorsten Halle, FMB	

7.9 Biomedical Materials II

Course name	Biomedical Materials II	Exam number: 601435
German title	Werkstoffe in der Medizintechnik II	
Teaching aims and content of the module	Teaching aims and competences to be gained: Students will be able to – classify material groups like refractory metals and alloys, polymers and ceramics that are commonly used as biomaterials for endo- and exoprosthesis as well as biomechanical applications – describe material characteristics (atomic structure, microstructural constituents, mechanical properties) and typical applications in biomechanical products	
	Contents: – materials: refractory metals and alloys, glasses, ceramics, polymers, hydrogels, composite materials – properties: microstructure, mechanical, corrosive, biocompatibility, wear, fatigue, failure – sterilization methods – patient individual additive manufacturing – dental applications, orthopedic applications, cardiological application, applications in otolaryngology	
Type of lecture	lectures; seminars	
Literature	will be given in the first lecture	
Preconditions for attending	recommended: successful completion of Biomedical Materials I and basic knowledge in materials science	
Usability of the module	according to module handbook	
Prerequisites for the provision of ECTS	written examination (K90)	
ECTS and marks	5 CP grading according to the examination regulations	
Efforts	2 hours per week lecture, 1 hours per week exercises, self-study	
Frequency of provision	every summer term	
Duration of module	1 semester	
Responsible lecturers	Prof. Dr.-Ing. habil. Manja Krüger, FMB	

7.10 Business Decision Making

Course name	Business Decision Making	Exam number: 50115
German title	Unternehmerische Entscheidungsfindung	
Remark	The most current module description can be found in the module handbook of the Master's program "Betriebswirtschaftslehre / Business Economics" of the Faculty of Business and Economics in the valid version, which is available online in the administration handbook of the OvGU under http://www.verwaltungshandbuch.ovgu.de/Modulhandbücher	
Teaching aims and content of the module	Teaching aims and competences to be gained: The students	
	• will obtain a deeper theoretical understanding of individual, interactive, and group decision making, • can learn and train practical methods of decision support for prominent types of decision problems, • will acquire skills for analytical decision support.	
Type of lecture	Contents:	
	• Preferences and Decision Behavior • Utility Theory • Multiattribute Decisions • Decisions under Uncertainty • Sequential Decisions • Strategic Interactive Decisions • Group Decision Making and Negotiation	
Literature	• D. Kahneman: Thinking, Fast and Slow, 2012 • J. Hammond, R. L. Keeney, H. Raiffa; Smart Choices – A Practical Guide to Making Better Decisions, 2015 • R. T. Clemen, T Reilly: Making Hard Decisions, 3rd ed., 2013 • P. Goodwin, G. Wright: Decision Analysis For Management Judgment, 5th ed., 2014	
Preconditions for attending	none	
Usability of the module	according to module handbook	
Prerequisites for the provision of ECTS	examination: exam (K60) In general, a written exam, if necessary in online format, is preferred. The responsible person of the module therefore determines the type of examination (online or offline) based on the respective study and examination regulations latest 14 days before the examination.	
ECTS and marks	5 CP grading according to the examination regulations	
Efforts	lecture: 28h (2 SWS), seminar 14h (1 SWS), self-dependent studies: 108h	
Frequency of provision	every winter term	
Duration of module	1 semester	
Responsible lecturer	FWW Chair BWL, in particular Entrepreneurship	

7.11 Biotribological Systems

Course name	Biotribological Systems	Exam number: 606587
German title	Biotribologische Systeme	
Teaching aims and content of the module	Teaching aims and competences to be gained: • Learning the basic understanding of the biotribological systems in the human body • Learning the ability to design and optimize tribologically loaded components under the boundary conditions in the human body	
	Contents: • Biotribological system • Natural joints and ligaments (function, friction, wear, damage) • Prosthesis and implants (function, friction, wear, damage) • Bio–inspired materials, coatings, surfaces and lubricants • Material interaction (surface processing and functionalization) • Test methods	
Type of lecture	lectures and project work (seminar, presentation, and documentation of the project results)	
Literature	• Ostermeyer, G.–P. et al.: Multiscale Biomechanics and Tribology of in–organic and organic Systems. Springer Tracts in Mechanical Engineering, 2021 • Rao, T.V.V.L.N. et al.: Biotribology – Emerging Technologies and Applications. CRC Press, 2021 • Davim, J. P.: Biotribology. Wiley–ISTE, 2010 • Hamill, J. et al.: Biomechanical Basis of Human Movements. Wolters Kluwer Lippincott Williams & Wilkins, 2009 • Ahmed, S.: Tribology and Characterization of Surface Coatings. John Wiley & Sons Inc., 2022 • Roy, M.: Surface Engineering for Enhanced Performance against Wear. Springer, 2013	
Preconditions for attending	none	
Usability of the module	according to module handbook	
Prerequisites for the provision of ECTS	examination: written exam (K90)	
ECTS and marks	5 CP grading according to the examination regulations	
Efforts	2 semester hours per week lecture as well as project work, self–study (lectures and project work)	
Frequency of provision	every summer term	
Duration of module	1 semester	
Responsible lecturer	Prof. Dr.–Ing. habil. Dirk Bartel, FMB Dr.–Ing. Joachim Döring, FME–KORT	

7.12 Clinical Biomechanics

Course name	Clinical Biomechanics	Exam number: 606584
German title	Klinische Biomechanik	
Teaching aims and content of the module	Teaching aims and competences to be gained: Detection methods of pathophysiology, as well as treatment forms and de- tection methods of damage cases are central aspects of the module. With their gained knowledge of special imaging methods students can name advantages and disadvantages for special applications in orthopedics. Different conservative forms of treatment (arthroscopy) and invasive meth- ods (joint replacement) as well as techniques used are introduced. Students will be able to identify requirements for special materials, espe- cially carrier materials, with their gained theoretical and practical knowledge of the basics of cell therapy and biocompatibility. With the help of different types of prostheses and materials presented, stu- dents can assess advantages and disadvantages of respective designs and materials utilized. Different types of material failure of prostheses are shown and causes are discussed.	
	Contents: • Imaging methods (MRT, CT) • Forms of treatment (conservative and invasive) • Basics of cell therapy • Prosthesis materials and design-related material failure • In vitro simulation techniques • Particle analysis and particle isolation • Material-cell interaction • Microscopic detection of implant wear and cellular reactions	
Type of lecture	Learning lab (experience-oriented seminar)	
Literature		
Preconditions for attending		
Usability of the module	according to module handbook	
Prerequisites for the provi- sion of ECTS	mandatory student participation in 85% of all courses as prerequisite for the examination (attendance sheet) final grading consists of 30 % marked coursework and 70 % written exami- nation (K120)	
ECTS and marks	5 CP grading according to the examination regulations	
Efforts	2 hours per week lecture, 1 hour per week exercises, self-study	
Frequency of provision	every summer term	
Duration of module	1 semester	
Responsible lecturer	Prof. Dr. rer. nat. Jessica Bertrand, FME-KORT Dr.-Ing. Joachim Döring, FME-KORT	

7.13 Computational Biomechanics

Course name	Computational Biomechanics	Exam number: 601397
German title	Computational Biomechanics	
Teaching aims and content of the module	Teaching aims and competences to be gained: The lecture is aimed to provide the students with knowledge and skills in computational mechanics to solve engineering problems (statics, strength of materials, dynamics). The lecture provides an introduction into the mathematical modeling and the computational analysis of engineering problems. The students receive the ability to solve simplified technical problems with a reference to biomechanical and medical engineering.	
	Contents: • Overview about modern computational methods in mechanics • Application in biomechanics and medical engineering • Introduction in mathematical modeling • Discretization methods: ◦ Finite difference method (FDM) ◦ Energy Methods (Ritz, Galerkin) ◦ Finite element method (FEM) • Computational analysis of selected problems in biomechanics	
Type of lecture	Lectures; Seminars	
Literature		
Preconditions for attending	understanding of basic mechanisms for measure properties, testing and analytics	
Usability of the module	according to module handbook	
Prerequisites for the provision of ECTS	oral examination, individual semester assignment	
ECTS and marks	5 CP grading according to the examination regulations	
Efforts	2 hours per week lecture, 2 hours per week exercises, self-study: individual semester assignment that is included in the examination grade	
Frequency of provision	every winter term	
Duration of module	1 semester	
Responsible lecturer	Prof. Dr.-Ing. Daniel Juhre, FMB	

7.14 Design, Additive Manufacturing and Powder Requirements

Course name	Design, Additive Manufacturing and Powder Requirements	Exam number 601391
German title	Design, additive Fertigungsprozesse und Pulver-Eigenschafts-Zusammenhänge	
Teaching aims and content of the module	Teaching aims and competencies to be gained: • Fundamental knowledge of Additive manufacturing (AM) and understanding of operating principles, capabilities, and limitations of state-of-the-art AM techniques (polymers, composites, metals, etc.) • Understanding of key design rules and optimization strategies for AM • General comprehension of the pre- and post-processing workflow • Understanding the requirements for powders for different AM techniques (size distribution, morphology, flowability, sensitivity against moisture and oxidation, reusability, etc.) • Ability to identify and estimate properties of AM builds in relation to the processing method (microstructure – properties relationship) • Common understanding of current methods of nondestructive inspection/testing (NDI/NDT) and AM-Standards • Comprehension of applications of AM across industries, including aerospace, automotive, biomedical, energy, electronics, and consumer ind. • Hands-on experience with a variety of AM machines; application of knowledge to projects and fabrication of sample parts Contents: • Fundamentals of Additive Manufacturing (AM), capabilities and benefits in the Product Development Process (Prototyping/Tooling/Manufacturing) • AM processes and technologies (polymers, composites, metals, etc.) • Design for AM and topology-optimization strategies • Workflow of pre-processing and post-processing for AM • Powder requirements, analyzing and testing of powder properties • Microstructure-properties relationship of AM materials (polymers, composite materials, metals and alloys) • Nondestructive Inspection/Testing (NDI/NDT) and Standards	
Type of lecture language	lectures and exercises, self-study	english
Literature	See lecture handout	
Preconditions for attending	none	
Usability of the module	according to module handbook	Limited participation
Prerequisites for the provision of credit points	Advanced provisions: Exercise credits Examination: Written Exam (90 min) K90	
credit points and marks	5 CP Grading according to the examination regulations	
Workload	Attendance and presence times: 2 SWS lectures, 2 SWS exercises Self-study: pre- and post-preparation of lectures and exercises, study of literature, execution of exercises, and preparation of short presentations	
Frequency of provision	each winter semester	
Duration of module	one semester	
Responsible lecturer	Prof. Krüger, FMB	

7.15 Design of Mechatronic Systems

Course name	Design of Mechatronic Systems	Exam number: 606591
German title	Entwurf mechatronischer Systeme	
Teaching aims and content of the module	Teaching aims and competences to be gained: - Fundamentals and application examples of system development and development methodology of mechatronic systems - Fundamentals and application examples of modelling and simulation of mechatronic systems	
	Contents: - Fundamentals of the specification of mechatronic systems: modelling of mechanical, electronic and information systems components - Mechatronic functional systems based on the example of medical engineering: mobility and rehabilitation aids, prosthetics, exoskeleton - Interaction of mechatronic systems	
Type of lecture	Lectures; Seminars	
Literature		
Preconditions for attending	fundamentals of mechanical engineering, electrical engineering or mechatronics, numerical simulation methods	
Usability of the module	according to module handbook	
Prerequisites for the provision of ECTS	examination: written exam (K90) or questionnaire and report (will be defined at the beginning of the course)	
ECTS and marks	5 CP grading according to the examination regulations	
Efforts	3 hours per week seminar, self-study	
Frequency of provision	every summer term	
Duration of module	1 semester	
Responsible lecturer	Prof. Dr.-Ing. Andreas Scholz, FMB	

7.16 Dynamics of Motion

Course name	Dynamics of Motion	Exam number: 606592
German title	Bewegungsdynamik	
Teaching aims and content of the module	Teaching aims and competences to be gained: • Students acquire knowledge on modelling and simulation of dynamic systems with focus on exoprostheses • Students receive basic understanding of numerical methods to solve the underlying differential equations • Students get the ability to solve dynamic problems and analyse the over-all motion due to acting forces in biomechanical context • Students acquire knowledge to solve inverse problems based on measured kinematic quantities for motion analysis	
	Contents: kinematics and kinetics of multibody systems to describe the motion of exoprostheses • kinematics including plane and spatial kinematics (linear and angular motion), orientation parameters and initial position problems • kinetics including single and multiple degree of freedom systems (linear and angular motion), vibrations, spatial dynamics of rigid bodies, introduction of joints and generalized coordinates • forward analyses including time integration methods, muscle models • and biomechanical applications • inverse analyses including inverse kinematics and dynamics	
Type of lecture	Lectures and exercises	
Literature		
Preconditions for attending	understanding of basic mechanical mechanisms (statics, strength of materials and dynamics)	
Usability of the module	according to module handbook	
Prerequisites for the provision of ECTS	Prerequisite for examination: project report/homework Examination: written exam K120	
ECTS and marks	5 CP grading according to the examination regulations	
Efforts	2 hours per week lecture, 2 hours per week exercises, self-study: pre- and post-preparation of lectures, exercises and exam	
Frequency of provision	Each summer term	
Duration of module	one semester	
Responsible lecturer	Prof. Dr.-Ing. Elmar Woschke, FMB Additional instructors: Dr.-Ing. Christian Daniel, FMB	

7.17 Imaging and Visualization in Biomedical Engineering

Course name	Imaging and Visualization in Biomedical Engineering	Exam number: 604378
German title	Verfahren der Biomedizinischen Bildgebung	
Teaching aims and content of the module	Teaching aims and competences to be gained: • Understanding the physics of different imaging approaches relevant for biomedical engineering • Learning about typical implementations • Pros and cons of the different methods with respect to biomedical engineering applications	
	Contents: Imaging methods in 2D and 3D, including various methods like CT, dual energy and spectral X-ray absorption, phase contrast imaging, fluorescence imaging, nanoparticle imaging, Nuclear medical imaging basics, MRI, Ultrasound imaging, Microscopy	
Type of lecture	Lectures; Seminar/Exercises	
Literature	• Andrew Webb: Introduction to Biomedical Imaging • Peter Morris: Biomedical Imaging: Applications and Advance • Nadine Barrie Smith, Andrew Webb: Introduction to Medical Imaging: Physics, Engineering and Clinical Applications • Bushberg, Seibert, Leidholt, Boone: The essential Physics of Medical Imaging • Hendee, Russell Ritenour: Medical Imaging Physics • Olaf Dössel: Bildgebende Verfahren in der Medizin • Giussani, Hoeschen: Imaging in Nuclear Medicine	
Preconditions for attending	basic knowledge in physics and mathematics	
Usability of the module	according to module handbook	
Prerequisites for the provision of ECTS	attending of exercises examination: written examination (K120)	
ECTS and marks	5 CP grading according to the examination regulations	
Efforts	2 hours per week lectures, 1 hour per week seminar, self-study	
Frequency of provision	every winter term	
Duration of module	1 semester	
Responsible lecturer	Prof. Dr. rer. nat. Christoph Hoeschen, FEIT-IMT	

7.18 Interdisciplinary Project

Course name	Interdisciplinary Project	Exam number: 604158
German title	Wissenschaftliches Projekt	
Teaching aims and content of the module	Teaching aims and competences to be gained: Students will work under supervision and as part of a team to holistically work on a topic related to the chosen specification. All competences acquired up to this point are to be incorporated and applied e.g. project management methods; creative, autonomous and aim-oriented working;...	
	Contents: Collaborative work on the project. Topics can vary widely and students are given the chance to participate in topic finding. Teams will consist of 2–4 students. Workload can include the conceptualization and design of a medical device, practical investigations in various labs, theoretical considerations, simulations, calculations, milestone presentations, etc.. A final scientific paper is to be written at the end of the project work summarizing the project output.	
Type of lecture	independent working in a team, consultations, seminars	
Literature	none	
Preconditions for attending	recommended to be solved within the third term	
Usability of the module	according to module handbook	
Prerequisites for the provision of ECTS	mode of examination: Scientific project final grading will consist of marked presentations and a marked scientific paper	
ECTS and marks	5 CP grading according to the examination regulations	
Efforts	self-study	
Frequency of provision	every winter term	
Duration of module	1 semester	
Responsible lecturer	Prof. Dr.-Ing. habil. Thorsten Halle, FMB	

7.19 Introduction in Tissue Engineering

Course name	Introduction in Tissue Engineering	Exam number: 604380
German title	Einführung in das Tissue Engineering	
Teaching aims and content of the module	Teaching aims and competences to be gained: While the lecture aims to impart fundamental knowledge and basic principles in tissue engineering, the exercise should facilitate the transfer of knowledge to practical problem solving. Learning Outcomes: Students are able to: 1. Explain the fundamental principles of cell biology and signaling pathways involved in the regulation of cells and tissues, and apply this knowledge to specific problems. 2. Describe the tissue-specific properties of the extracellular matrix (ECM) and use this knowledge to derive requirements and implicit design principles for implant materials and delivery systems in tissue engineering. 3. Classify histological stains and antibody-based detection methods (e.g., ELISA, RIA, FACS, MACS) in terms of their principles, fields of application, and interpretation. 4. Provide a technical explanation of bioreactor-specific concepts, sensor technology, and non-invasive detection methods in the context of tissue engineering, and critically discuss their potential and limitations. 5. Structure and critically evaluate scientific publications on the module's main topic, and present the evidence in a clear and logical argument. 6. Appropriately use AI-supported tools in the scientific work process, in particular by – technically verifying AI outputs (e.g., plausibility, source reliability, potential sources of error), – making sources and information transparent, – ensuring their own scientific responsibility for content, conclusions, and interpretation, – and documenting AI use in accordance with established documentation guidelines.	
	Contents: • Basics of cell biology and tissue engineering • Structure, composition and functions of the ECM • Materials and manufacturing technologies of scaffolds in tissue engineering and implants • Cell culture technology and stem cell culture/differentiation • Methods for characterizing cell function, cell-cell and cell-matrix interaction • Non-destructive characterization methods of 3D tissues • Bioreactor and sensor technology in Tissue Engineering • Lab and Organ on a Chip technologies • Training systems (phantoms) for medical training • Alternatives to test testing in cosmetics and drug development • State of regenerative medicine using cell-based therapies	
Type of lecture	Lectures, Seminar (Tutorial)	
Literature	Textbooks and current internet links will be discussed and made available during the lectures	
Preconditions for attending	interested in cell biology, material development, tissue engineering, regenerative medicine and biotechnology, alternatives to animal testing	
Usability of the module	according to module handbook	

Prerequisites for the provision of ECTS	50% oral presentation of scientific question and 50% Exam (K90) Final Presentation (Group Project) Content: Scientific presentation of a thematically relevant focus area from the module (e.g., cell/signaling pathways, ECM properties, detection methods, bioreactors/sensor technology/non-invasive detection, application of 3D tissues). Requirements: Development of a clear line of reasoning (problem → evidence → interpretation → conclusion) with a critical review of the relevant literature. AI Transparency Rule (formal documentation, mandatory!): "The group must document its use of AI in a standardized appendix: tool(s), purpose of use, prompt/strategy excerpt (if applicable and essential), as well as the sources on which the final statements are based. The AI documentation is part of the evaluation." Admissibility: AI may be used as a support tool, but it does not replace expert review or the group's own scientific argumentation. Written Final Exam – (K90) Objective: To assess students' subject knowledge and understanding of key concepts (including cell biology/signaling pathways, ECM, interpretation of methods, bioreactors/sensor technology/detection) and their ability to apply this knowledge to unfamiliar problems within the context of the module.
ECTS and marks	5 CP grading according to the examination regulations
Efforts	2 hours per week lecture, 2 hours per week seminar, supporting tutorials
Frequency of provision	every winter term; the course is limited to a maximum of 25 students
Duration of module	1 semester
Responsible lecturer	Dr. Sascha Kopp, FVST-ICH

7.20 Introduction to Medical Science in Space

Course name	Introduction to Medical Science in Space	Exam number: 601361
German title	Einführung in die Medizinische Weltraumforschung	
Teaching aims and content of the module	Teaching aims and competences to be gained: The course provides an introduction to the fundamentals and methods of biomedical research under microgravity conditions. For this purpose, the special properties and effects of a microgravity environment on cells, organisms and humans, which outline the possibilities for research under a unique environmental condition. Technical requirements of the different realization options for experiments in microgravity are presented and the process from project idea to implementation is taught. This will provide students an overview of the main experimental approaches to microgravity platforms as well as the design and implementation of projects in various scientific, engineering and medical fields. Contents: <u>Lecture</u>: • History of space science (Mercury, Apollo, Vostok, MIR, Skylab etc.) • Platforms for microgravity research: rotational bioreactors, drop tower, parabolic flight, sounding rockets (suborbital), satellites, space stations • Human physiology under microgravity conditions (musculoskeletal system, cardiovascular system, immune system), typical diseases of astronauts, cognitive impairment, "space pharmacology", bed rest studies, human centrifuges. • Perception of gravity, cell physiology under gravitational stress, genetics and epigenetics in microgravity. • Application of microgravity to terrestrial problems in medicine (for example, research on cancer, cartilage, vascular system), tissue engineering under microgravity conditions. • Technology development for biomedical space research: hardware requirements and tests, technical implementations. • Technological challenges and strategies in human space exploration: life support systems, space greenhouses, radiation protection. <u>Seminar</u>: • Milestones, current methods and technologies in medical space research.	
Type of lecture	lecture (2 SWS), seminar (2 SWS)	
Literature	[1] G. Ruyters, M. Braun (Eds): „SpringerBriefs in Space Life Sciences“ (book series; currently 13 titles), Springer Verlag, ISSN: 2196–5560 [2] B. Ganse, U. Ganse: „Das kleine Handbuch für angehende Raumfahrer“, Springer Verlag, 1st edition 2017, ISBN: 978–3662544105	
Preconditions for attending	recommendation: basic knowledge in biology and physics	
Usability of the module	according to module handbook	
Prerequisites for the provision of ECTS	examination: written exam (K90)	
ECTS and marks	5 CP grading according to the examination regulations	
Efforts	lecture: 28h (2 SWS), seminar 28h (2 SWS), self-dependent studies: 94h	
Frequency of provision	every summer term; the course is limited to a maximum of 15 students	
Duration of module	1 semester	
Responsible lecturer	Prof. Dr. med. Daniela Grimm, FME–MTRM Additional Instructors: Dr. rer. nat. Markus Wehland, Dr. rer. nat. Marcus Krüger; Dr. rer. medic. Herbert Schulz, Dr. rer. nat. Kirsten Harth, FME–MTRM	

7.21 Marketing Performance Management

Course name	Marketing Performance Management	Exam number: 41058
German title	Marketing Performance Management	
Remark	The most current module description can be found in the module handbook of the Bachelor's program "International Business and Economics" of the Faculty of Business and Economics in the valid version, which is available online in the administration handbook of the OVGU under http://www.verwaltungshandbuch.ovgu.de/Modulhandbücher	
Teaching aims and content of the module	Learning objectives and acquired competences: The objective of this course is to define and explain the fundamental aspects of marketing performance management with special emphasis on marketing controlling. After successful completion of this course students will	
	• acquire new knowledge in the basics of marketing controlling and be able to apply instruments of marketing performance management independently, • understand the emergence and relevance of fundamental marketing concepts and metrics, • have a sound understanding of different approaches for measuring, for example, brand equity, customer equity, and corporate reputation, and • gain first insights on online performance marketing.	
	Contents: • Introduction: from the transaction- to the relationship-paradigm • Methods of marketing performance management • Customer equity management • Corporate branding • Online performance marketing • Web analytics, text mining & social media analytics	
Type of lecture	lecture (2 SWS), seminar (2 SWS)	
Literature	• Sarstedt, M. and E. A. Mooi (2019). A Concise Guide to Market Research. The Process, Data, and Methods Using IBM SPSS Statistics. 3rd edition, Springer: Berlin et al. • Homburg, C., Kuester, S. and H. Krohmer (2013). Marketing Management A Contemporary Perspective, 2nd edition, McGraw Hill, Higher Education. • Chaffey, D. and PR. Smith (2017). Digital marketing Excellence: Planning, Optimizing and Integrating Online Marketing. 5th edition, Taylor & Francis Ltd.: Oxford et al.	
Preconditions for attending	none	
Usability of the module	according to module handbook	
Prerequisites for the provision of ECTS	examination: exam (K60) In general, a written exam, if necessary in online format, is preferred. The responsible person of the module therefore determines the type of examination (online or offline) based on the respective study and examination regulations latest 14 days before the examination.	
ECTS and marks	5 CP grading according to the examination regulations	
Efforts	lecture: 28h (2 SWS), seminar 28h (2 SWS), self-dependent studies: 94h	
Frequency of provision	every winter term	
Duration of module	1 semester	
Responsible lecturer	FWW chair BWL, in particular Marketing	

7.22 Material Modeling

Course name	Material Modeling	Exam number: 601408
German title	Werkstoffmodellierung	
Teaching aims and content of the module	Teaching aims and competences to be gained: • Overview of methods of computational materials science at different scales • Prediction of material properties using physically-based models • Application of different programs to carry out simulations	
	Contents: • Basics of modeling, with a focus on material science and engineering • Scale dependence and applicability of various physical models; selection of methods appropriate for engineering tasks • Introduction to: ◦ Density functional theory (quantum chemistry) ◦ Atomistic simulation ◦ Dislocation modelling ◦ Phase field modeling ◦ Monte Carlo Methods ◦ Cellular Automata ◦ Heat Treatment Simulation for Steels • Bridging the scales by combination of different techniques • Lectures are complemented by computer simulations in exercises and demonstrations	
Type of lecture	Lectures; Computer Lab	
Literature	The Simulation of Materials, Microstructures and Properties, Wiley 2004 Crystals, Defects and Microstructures, Cambridge Univ. Press 2004	
Preconditions for attending	Bachelor's level understanding of materials science	
Usability of the module	according to module handbook	
Prerequisites for the provision of ECTS	oral examination	
ECTS and marks	5 CP grading according to the examination regulations	
Efforts	2 hours per week lecture, 1 hour per week seminar, self-study	
Frequency of provision	every summer term	
Duration of module	1 semester	
Responsible lecturer	Prof. Dr.-Ing. habil. Thorsten Halle, FMB, Additional instructors: Dr.-Ing. Sebastian Hütter, FMB; Prof. Dr.-Ing. Daniel Juhre, FMB	

7.23 Materials Science

Course name	Materials Science	Exam number:
German title	Werkstoffwissenschaften	
Teaching aims and content of the module	Teaching aims and competences to be gained: • Deeper understanding of physical and mechanical phenomena in metals and alloys • Gain deeper knowledge of the mechanical properties at high temperatures • Ability to combine microstructural relationships with macroscopic properties of metallic materials and alloys	
	Contents: • Crystal structures and symmetry classes • General theory of dislocations and dislocation reactions ○ Perfect dislocations ○ Partial dislocations ○ Defects in dislocations • Grain boundary theory ○ Tilt and twist grain boundaries ○ Twin and large angle grain boundaries ○ Dislocation network in grain boundaries • Elastic and plastic deformation ○ Plastic behavior of single crystals ○ Plastic deformation at high temperatures – creep • Strengthening mechanisms in metallic materials and alloys • Introduction into thermodynamics of phase transformations and complex phase diagrams	
Type of lecture	Lectures; Seminars for special topics	
Literature	See first lecture	
Preconditions for attending	Master’s level understanding of metals, alloys and materials science	
Usability of the module	according to module handbook	
Prerequisites for the provision of ECTS	Written examination K90	
ECTS and marks	5 CP Grading according to the examination regulations	
Efforts	2 hours per week lecture, 1 hour per week seminar, self-study of lectures and seminars	
Frequency of provision	Each summer semester	
Duration of module	1 semester	
Responsible lecturer	Dr.–Ing. Georg Hasemann, FMB–IWTM Dr.–Ing. Sebastian Hütter, FMB–IWTM	

7.24 Master Thesis

Name des Moduls	Master Thesis
Deutscher Titel	Masterarbeit
Content and qualification goals of the module	Learning objectives and acquired competences: The Master's thesis should demonstrate that the student is able to work independently on a problem using scientific methods within a given period of time, as well as to analyze and critically evaluate possible approaches to solving the problem. The students are able to classify their work in the context of current research. Contents: Topics from all relevant disciplines of the Faculty of Mechanical Engineering with a clear reference to biomechanical issues, preferably with an orientation towards engineering-relevant issues.
Teaching forms	self-study, colloquium in compliance with the design guideline as well as instructions for the processing and presentation of final theses of the FMB
Requirements for the start of the master work	proof of 70 CP from compulsory and elective courses and completed module "interdisciplinary project"
Prerequisite for the colloquium	proof of all required 90 CP presentation of two expert opinions on the Master's thesis, graded at least "sufficient"
Usability of the module	M-BiME
Prerequisites for the award of credit points	2 expert opinions, colloquium
Credit points and grades	30 CP grading scale according to examination regulations
Workload	independent project work, master thesis, lecture
Offering frequency	every semester
Duration of the module	20 weeks issue of the topic and submission of the master's thesis on record in the examination office of the FMB
Responsible for the module	study program coordinator

You can find more detailed information on the organization and procedure of your Master's thesis in the General Study and Examination Regulations for the Master's degree programs of the faculties participating in the Engineering Campus of Otto von Guericke University Magdeburg.

https://www.bekanntmachungen.ovgu.de/H%C3%B6B+Teil+I/1_06+Pr%C3%BCfungsordnungen-mechanik_id-12442-p-48.html

7.25 Medical Device Regulation and Ethics in Medicine

Course name	Medical Device Regulation and Ethics in Medicine
Deutscher Titel	Medizinprodukterecht und Medizinethik
Structure	The module is divided into two parts semesters, each of which takes place in one semester: - Part I comprises the course "Introduction to the approval process of medical devices" given by P Dr.-Ing. Melanie Fachet - Part II comprises the course "History and Ethics of Medicine and Medical Engineering" given by Prof. Dr. phil. habil. Bettina Hitzer

Part I:

Course name	Introduction to the approval process of medical devices ^{4*}	Exam number: 702309
Deutscher Titel	Einführung in das Zulassungsverfahren für Medizinprodukte	
Teaching aims and content of the module	In contrast to pharmaceuticals, no worldwide uniform legally requirements are available for the approval and CE certification of medical devices. Every manufacturer is responsible to set up the process and documentation of his medical devices to get it approved according to defines OECD Guidelines and ISO norms. The regulatory affair offers an unexpectedly exciting and diverse range of tasks for all students, especially in small and medium-sized companies. As part of the elective module, we want to arouse students' interest in these regulatory affairs topics in the modules including active participation of representatives of the medical device industry. We want to teach the essential basics for an activity in the regulatory environment. In the first semester, we will address the process as whole as well as regulatory and structural requirements.	
	Contents: The content is based on the specifications for the European CE approval and relevant DIN ISO specification. It includes the following topics: • Introduction to the process of market approval • GxPractice and alternative We will build groups of two students to perform a Term work. Content of work are selected examples to illuminate the approval procedures for different medical device classes and to address particular regulatory issues. These Term work are presented and discussed in a short lecture to all students. The homework is 50% of the examination performance. In addition, an exam is written at the end of the course, which also accounts for 50% of the total grade.	
Type of lecture	Lecture; Seminar	
Literature	will be made available digitally at the beginning of the course	
Preconditions for attending	none	
Usability of the module	according to module handbook	
Efforts	2 hours per week lecture, 1 hour per week exercises, autonomous work: follow-up lecture and exercises, elaboration of term paper	
Frequency of provision	every winter term, Note: no course offered in the summer semester of 2026; instead, it will be postponed to the winter semester of 2026–27.	
Prerequisite for the admission to any examination	term paper and its presentation	
Responsible lecturer	Dr.–Ing. Melanie Fachet, FEIT	

4*) The module will be mentioned in the planning of the lectures as “MRA I – Introduction to the approval process of medical devices”.

Part II

Course name	History and Ethics of Medicine and Medical Engineering	Exam number: 606585
Deutscher Titel	Geschichte und Ethik der Medizin und Medizintechnik	
Teaching aims and content of the module	The aim of the module is to introduce students to basic developments in the history of medicine and medical technology as well as to fundamental principles of ethical reasoning. Against the background of historical processes, students should become aware of the opportunities and challenges of advances in medicine and technology. They will understand how medical knowledge and technological innovation are entangled with social, political, and economic conditions and simultaneously shape them. The focus here is on the human-machine relationship as well as on ideas about the human being as biological-technical hybrid being (cyborg). In addition, students will become acquainted with ethical considerations that are important for the process of designing exo- and endoprosthesis as well as for drafting the so-called “Ethikantrag” during approval processes.	
	Content: • Major developments in medicine and medical engineering • Principles of ethical decision-making in medicine and medical engineering • Human-machine relationship and humans as cyborgs In cooperation with the module “Interdisciplinary Project”, we will reflect in class on which ethical aspects should be addressed and how one could assess ethical challenges and chances of these projects. As term work, students should explore the ethical challenges of the projects they are working on in the module “Interdisciplinary Project”. These term papers will be presented and discussed in class. Term paper and presentation will be marked and the grading accounts for 50 % of the total grade. The exam written at the end of the semester (multiple choice exam) will account for the other 50 %.	
Type of lecture	Lecture; Seminar	
Literature	• Ibo van de Poel et al.: “Ethics, technology, and engineering”, Chichester: Wiley-Blackwell 2011 • O. Ewaleifoh et al.: “Biomedical Engineering Ethics”, in: Tania S. Douglas (ed.): Biomedical Engineering for Africa, University of Cape Town 2019, Chapter 17: DOI: http://dx.doi.org/10.15641/0-7992-2544-0 • Ethik in der Medizin. Ein Studienbuch, 5. erw. Aufl. 2020 • Rolf-Jürgen Gleitsmann, Rolf-Ulrich Kunze, Günther Oetzel, Moderne Technikgeschichte. Eine Einführung in ihre Geschichten, Theorien, Methoden und aktuellen Forschungsfelder, 2022	
Usability of the module	according to module handbook	
Efforts	2 hours per week lecture, 2 hours per week exercises, self-study: follow-up lecture exercises, preparation and presentation of term paper	
Frequency of provision	every winter term	
Prerequisite for the admission to any examination	term paper and its presentation	
Responsible lecturer	Prof. Dr. phil. habil. Bettina Hitzer, FME-GET	

Prerequisites for the provision of ECTS	Part I: Introduction to the approval process of medical devices: written examination (K90) (grading will consist of term paper and exam each 50 %) Part II: History and Ethics of Medicine and Medical Engineering: written examination (K90) (grading will consist of term paper and exam each 50 %)
ECTS and marks	10 CP grading according to the examination regulations, final grade will be calculated as equal combination of the exams part I (50 %) and part II (50 %)
Frequency of provision	Part I: winter term, Part II: winter term
Duration of module	2 semesters
Responsible lecturers	winter term: Dr.-Ing. Melanie Fachet, FEIT winter term: Prof. Dr. phil. habil. Bettina Hitzer, FME-GET

7.26 Medical Technology from a Company Perspective

Course name	Medical Technology from a Company Perspective	Exam number: 601372
German title	Medizintechnik aus Unternehmensperspektive	
Teaching aims and content of the module	Teaching aims and competences to be gained: • Lectures are provided by various companies to provide real world insights • Weekly changing content dependent on the presenting company • Topics covered are product development, manufacturing, testing, sterilization, regulatory approval of medical devices from various application areas • Students will learn about medical devices developed and produced by small and medium-sized medical technology companies in Saxony-Anhalt • Students apply knowledge on consequences and requirements for medical devices in a problem-based approach	
	Contents: Presentations and product demonstrations of • Plastic tubing • Injection moulding technology • Sterilization service provider for medical devices • Diagnostic point-of-care analysers • Digital health apps • Product development • Clinical evaluation • Being a Start up in Med Tec	
Type of lecture	lectures and project work (documentation of the project results and presentation)	
Literature	–	
Preconditions for attending	none	
Usability of the module	according to module handbook	
Prerequisites for the provision of ECTS	examination: 50% marked coursework, 50% presentation	
ECTS and marks	5 CP grading according to the study and examination regulations	
Efforts	2 semester hours per week lecture as well as project work, self-study (lectures, project work, preparation of presentation)	
Frequency of provision	every summer term	
Duration of module	1 semester	
Responsible lecturer	Dr.-Ing. Axel Boese, FME-INKA	

7.27 Microscopic Methods

Course name	Microscopic Methods	Exam number: 601369
German title	Mikroskopische Methoden in der Medizintechnik	
Teaching aims and content of the module	Teaching aims and competences to be gained: Microscopic methods are fundamental for characterizing the structure, surface and the chemical composition of materials, cells and tissues in order to understand their behaviors and interactions. Various physical effects can be used both for imaging of surfaces and for analyzing the structure and/or chemical composition. Depending on the microscopic method used and the preparation needed, these are destructive or non-destructive methods. The choice of methods is essentially determined by the combination of the aim of the investigation and the nature of the material, cell or tissue. This lecture will focus on the combination of preparation and the type of microscopic investigation with method-related applications as well as individual limitations such as detection limits, lateral and spectral resolutions, qualitative and/or quantitative measurements and others aspects for different types of microscopy. Contents: • Preparation of materials and tissues for microscopy • Fundamentals and applications of optical microscopy • Fundamentals and applications of electron microscopy • Materials characterization and analysis • Fluorescence microscopy	
Type of lecture	Lectures; Practical Courses	
Literature		
Preconditions for attending	none	
Usability of the module	according to module handbook	
Prerequisites for the provision of ECTS	mandatory student participation in 75% of all practical courses (3 out of 4) as prerequisite for the examination (attendance sheet)	
	written examination (K90)	
ECTS and marks	5 CP grading according to the examination regulations	
Efforts	2 hours per week lecture, 1 hours per week practical course, self-study	
Frequency of provision	every summer term, the course is limited to a maximum of 25 students	
Duration of module	1 semester	
Responsible lecturer	Dr.-Ing. Markus Wilke, FMB Additional lecturers: Prof. Dr. rer. nat. Jessica Bertrand, FME-KORT Prof. Dr. rer. nat. Andreas Müller, FME-IMKI Dr. Werner Zuschratte, LIN	

7.28 Motion Analysis

Course name	Motion Analysis	Exam number: 604374
German title	Funktionale Bewegungsanalyse	
Teaching aims and content of the module	Teaching aims and competences to be gained: The lecture is aimed to provide the students with knowledge and skills in theoretical foundations, methods, and specific applications of motion analysis. In the exercises, students learn to apply the special procedures to selected human movements.	
	Contents: • Basics of motor control • Biomechanical modelling • Statistics in motor control • Gait analysis • Procedures of motion analysis ◦ Optical methods ◦ Inertial sensors ◦ Dynamometry ◦ Electromyography • Postural control • Virtual reality in human movement science	
Type of lecture	Lectures; Exercises	
Literature		
Preconditions for attending	successful completion of the modules Anatomy for Engineering Students and Applied Biomechanics is recommended	
Usability of the module	according to module handbook	
Prerequisites for the provision of ECTS	written examination (K120)	
ECTS and marks	5 CP grading according to the examination regulations	
Efforts	2 hours per week lecture, 1 hours per week exercises, self-study: individual semester assignment that is included in the examination grade	
Frequency of provision	every winter term	
Duration of module	1 semester	
Responsible lecturer	apl. Prof. Dr. habil. Kerstin Witte, FHW-SPW	

7.29 Orthopedic Technology

Course name	Orthopedic Technology	Exam number: 606580
German title	Orthopädietechnik	
Teaching aims and content of the module	Teaching aims and competences to be gained: The aim of the module is to understand the basics of biomechanics based on the understanding of the physiological processes of healthy joints and to enable students to assess the influencing factors involved in orthopedically relevant joint diseases on the basis of basic knowledge of medicine, biology, mechanics and tribology. Important prerequisites for this are the knowledge to be acquired of the basics of the anatomy and physiology of relevant joints and structures (bones, cartilage, muscles and ligaments). Various relevant orthopedic aids and implants as well as test setups are introduced, as well as the corresponding basic normative requirements.	
	Contents: • Basics of cell biology and physiology of joints • Introduction to pathophysiology in orthopaedics • Basics of biotribology and biomechanics and experimental design • Forces and moments in joints • Normative requirements in biomechanics • Alloplastic and Biologics • Implants and devices for hip, knee, shoulder and spine surgery • Robotics in orthopaedic surgery • Exoprosthetics	
Type of lecture	Learning lab (experience-oriented seminar)	
Literature		
Preconditions for attending	none	
Usability of the module	according to module handbook	
Prerequisites for the provision of ECTS	mandatory attendance of students in 85% of all supervised in-class sessions as an examination requirement (proof of attendance) examination: written exam (K120)	
ECTS and marks	5 CP grading according to the examination regulations	
Efforts	will be announced at the start of the module in the respective semester	
Frequency of provision	every winter term	
Duration of module	1 semester	
Responsible lecturer	Prof. Dr. med. Christoph Lohmann, FME-KORT	

7.30 Product Design and Drafting

Course name	Product Design and Drafting	Exam number: 604375
German title	Produktdesign und Entwurf (PDE)	
Teaching aims and content of the module	Teaching aims and competences to be gained: The course aims to promote an understanding of the role of product design in integrated product development processes and to motivate an integrative approach. The human being as user and owner of products is the benchmark. Aesthetic-ergonomic requirements derived from this are examined in particular and considered in relation to other aspects of requirements. The core objective is to enable exemplary design-oriented and integrative product design. • Sensitisation to formal aesthetic qualities and training in design skills for the visual design of complex form design problems within exercises and vouch work. • Practical processes and applications from brainstorming, design drawing, digital sketching and prototyping to the product. • Recognition of formal qualities such as form formation, form quality, form expression in connection with use requirements and their form problems such as use form, use recognition and ergonomic dimensioning of form design. • Recognition of design interrelationships of formal-aesthetic, ergonomic and technical requirements to align the product design with user needs Contents: • The human being as user and owner of product-use-oriented design strategies and design methods • Human-centered design requirements and usability processes (aesthetics / perception and ergonomics) • Methodological procedures and analogue and digital design tools • Integrative process model and interface design with design disciplines • In-depth exercises in the plastic design of functional objects (sketching and modelling) by linking formal aesthetic, ergonomic and technical design requirements • Own production of models to check the perceptually appropriate quality of the design	
Type of lecture	Lectures; Seminars	
Literature	• Design als Produktsprache; Dagmar Steffen, Form-Verlag (November 1999), ISBN: 978-3931317348. • Design Basics; Gerhard Heufler, Niggli-Verlag (November 2012), ISBN: 978-3721208290. • Design Die 100 Prinzipien für erfolgreiche Gestaltung; Stiebner-Verlag (September 2004), ISBN: 978-3830712954.	
Preconditions for attending	none	
Usability of the module	according to module handbook	
Prerequisites for the provision of ECTS	examination: written exam (K120)	
ECTS and marks	5 CP grading according to the examination regulations	
Efforts	2 hours per week lecture, 2 hours per week exercises,	
Frequency of provision	every winter term	
Duration of module	1 semester	
Responsible lecturer	Dr.-Ing. Michael Schabacker, FMB	

8 Auflagenmodule | conditional modules

Nach § 4 Zulassungsvoraussetzungen Absatz (2) b) der studiengangspezifischen Studien- und Prüfungsordnung (sSPO) für den Masterstudiengang Biomechanical Engineering muss der absolvierte Abschluss (nach ECTS)

- mindestens 10 CP im Kompetenzbereich Mathematik,
- 15 CP im Kompetenzbereich maschinenbauliche Grundlagen,
- 5 CP im Kompetenzbereich materialwissenschaftliche Grundlagen
- 10 CP naturwissenschaftliche Grundlagen

aufweisen.

Eine Zulassung ist nur zulässig, wenn diese Anzahl an Creditpoints in den ausgewiesenen Kompetenzbereichen nicht unterschritten wird. Die Zulassung kann dann mit entsprechenden Auflagen verbunden sein. Diese Auflagen sind dann Module auf Bachelor-Niveau aus den Bachelorstudienprogrammen der OVGU oder spezielle Auflagenmodule der Fakultät für Maschinenbau. Die Modulbeschreibungen zu diesen Auflagenmodulen finden Sie in den entsprechenden Modulhandbüchern oder Modulkatalogen der entsprechenden Studiengänge oder in diesem Modulhandbuch im Kapitel 7.

Diese Module sind nur Auflagenmodule zum Ausgleich von Kompetenzdefiziten und können nicht in die Berechnung des Masterabschlusses eingebracht werden. Ein Ausweisen auf dem Zeugnis unter zusätzlichen Leistungen ist möglich.

According to § 4 admission requirements paragraph (2) b) of the study program specific study and examination regulations (sSPO) for the Master's program Biomechanical Engineering, the completed degree (according to ECTS) has to be

- at least 10 CP in the competence area mathematics,
- 15 CP in the competence area of mechanical and structural fundamentals,
- 5 CP in the competence area material science fundamentals
- 10 CP in scientific fundamentals

have.

Admission is only permitted if the number of credit points in the designated competence areas does not fall below this number. The admission can then be connected with corresponding conditions. These conditions are then modules on Bachelor level from the Bachelor study programs of the OVGU or special conditional modules of the Faculty of Mechanical Engineering. The module descriptions for these conditional modules can be found in the corresponding module handbooks or module catalogs of the corresponding study programs or in this module handbook in chapter 7.

These modules are only requirement modules to compensate for competence deficits and cannot be included in the calculation of the master's degree. They can be listed on the certificate under additional achievements.

8.1 Biochemical Engineering

Kein Angebot im WiSe 2025-26 / no offer in WiSe 2025-26

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	

8.2 CAx Basics

Course name	CAx Basics	Exam number: 604299
German title	CAx-Grundlagen	
Teaching aims and content of the module	Teaching aims and competences to be gained: • 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 • competencies 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)	
Type of lecture	lectures and CAx exercises accompanying lectures	English
Literature	see introduction lecture	
Preconditions for attending	none	
Usability of the module	according to module handbook / support module by subject advisor of the degree Biomechanical Engineering	
Prerequisites for the provision of credit points	examination: written exam on lecture content (K120), CAD exam (K90)	
Credit points and marks	5 CP grading according to the 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	every summer term	
Duration of module	1 semester	
Responsible lecturer	Dr.-Ing. Michael Schabacker, FMB	

8.3 Chemistry

Course name	Chemistry	Exam number
German title	Chemie	701201
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. Oxygen containing 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 prerequisites: 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	

8.4 Engineering Design Graphics

Course name	Engineering Design Graphics	Exam number:
German title	Technische Darstellungslehre	601418+601419
Teaching aims and content of the module	Teaching aims and competences to be gained: • learning and developing skills and abilities for the technical presentation 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 modeling (solid modeling, 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 drawings 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	
Type of lecture	lectures and exercises accompanying the lecture, independent work on assignments	English
Literature	announcement during the course	
Preconditions for attending	none	
Usability of the module	according to module handbook / support module by subject advisor of the degree Biomechanical Engineering	
Prerequisites for the provision of credit points	examination prerequisite: announcement at the beginning of the course two-part examination: written exam (K120) and 3D-CAD exam (K90)	
Credit points and marks	5 CP grading according to the examination regulations	
Workload	attendance times: 2 SWS lecture and 2 SWS tutorial self-study: independent preparation and follow-up of lectures and exercises, preparation of supporting documents	
Frequency of provision	every winter term	
Duration of module	1 semester	
Responsible lecturer	Dr.-Ing. S. Trautsch, FMB additional lecturers: Dr.-Ing. Schabacker, FMB	

8.5 Engineering Mechanics 1

Course name	Engineering Mechanics 1	Exam number
German name	Technische Mechanik 1	606599
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 • Truss structures • Internal forces in beams • Calculation of centroids. Fundamentals of Strength of Materials: • Assumptions and definitions for deformations and stresses, Hooke's Law • Basic stress types	
DQR Module level	Niveau 6: Bachelor	
Teaching forms language	Lectures, exercises, independent work	English
Literature		
Preconditions for attending	Recommended: Mathematics M1	
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	Each summer term	
Duration of module	One semester	
Responsible lecturers	Prof. Dr.-Ing. Daniel Juhre, Prof. Dr.-Ing. Elmar Woschke; FMB	

8.6 Engineering Mechanics 2/3

Course name	Engineering Mechanics 2/3	Exam number
German name	Technische Mechanik 2/3	606601
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, 4 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	

8.7 Fundamentals of Machine Elements

Course name	Fundamentals of Machine Elements	Exam number
German name	Grundlagen der Maschinenelemente	606598
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	Each summer term	
Duration of module	One semester	
Responsible lecturer	Prof. Dr.-Ing. Andre Katterfeld; FMB	

8.8 Introduction to Medical Engineering

Course name	Introduction to Medical Engineering	Exam number
German title	Einführung in die Medizintechnik	
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 provi-sion 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	

8.9 Materials I

Course name	Materials I	Exam number
German name	Werkstoffe I	601420
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, Usable 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	

8.10 Materials II

Course name	Materials II	Exam number
German name	Werkstoffe II	606604
Teaching aims and content of the module	Learning objectives and competencies to be acquired: Aim of the course is to generate a basic understanding of polymeric, ceramic, glass and composite materials and their materials and technical/application-related properties. Knowledge of process-structure-property relationships not only opens up opportunities for engineers to use materials efficiently, but also lays the foundation for modifying materials and adapting them to specific applications. Students acquire in-depth knowledge of the structure, processing, and applications of the aforementioned material classes and are able to recognize process-structure-property relationships and identify materials suitable for specific applications. Contents: material structure and processing of polymers, ceramics, glasses, and selected examples of composite materials electrical, magnetic, thermal, and optical properties of materials and relevant material examples corrosion and degradation behavior of materials and material protection	
DQR Module level	Niveau 6: Bachelor	
Teaching forms language	lecture, seminar and seminar-like exercises, practical teamwork on a given problem in individual work groups	English
Literature	will be given in the first lecture	
Preconditions for attending	recommended: Materials I	
Usability of module	According to module handbook, Usable as Erasmus exchange module	
Prerequisites for the provision of ECTS	Examination prerequisite: to be announced at the beginning of the course; written exam K90	
ECTS and marks	5 CP Grading following Study and Examination Regulations	
Efforts	Attendance times: 2 SWS Lecture, 1 SWS seminar and presentation time, 1 SWS lab courses self-study: pre- and post-preparation of lecture and seminar, ex-ercises, exams	
Frequency of provision	Each summer term	
Duration of module	One semester	
Responsible lecturer	Prof. Scheffler; FMB Additional lecturers: Dr. Betke, FMB	

8.11 Mathematics M1e

Course name	Mathematics M1e	Exam number												
German name	Mathematik M1E	501325												
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	<table> <tr> <td></td><td>In class</td><td>Self-study</td></tr> <tr> <td>Lecture Mathematics M1e</td><td>3 SWS / 42 h</td><td>66 h</td></tr> <tr> <td>Global tutorial Mathematics M1e</td><td>2 SWS / 28 h</td><td></td></tr> <tr> <td>Group tutorial Mathematics M1e</td><td>1 SWS / 14 h</td><td></td></tr> </table>			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	
	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													

8.12 Mathematics M2e

Course name	Mathematics M2e	Exam number												
German name	Mathematik M2E	501326												
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 differential 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	<table> <tr> <td></td><td>In class</td><td>Self-study</td></tr> <tr> <td>Lecture Mathematics M2e</td><td>3 SWS / 42 h</td><td>66 h</td></tr> <tr> <td>Global tutorial Mathematics M2e</td><td>2 SWS / 28 h</td><td></td></tr> <tr> <td>Group tutorial Mathematics M2e</td><td>1 SWS / 14 h</td><td></td></tr> </table>			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	
	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													

8.13 Mathematics M3e

Course name	Mathematics M3e	Exam number												
German name	Mathematik M3E	501327												
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–Lindelöf, 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	<table> <tr> <td></td><td>In class</td><td>Self-study</td></tr> <tr> <td>Lecture Mathematics M3e</td><td>3 SWS / 42 h</td><td>66 h</td></tr> <tr> <td>Global tutorial Mathematics M3e</td><td>2 SWS / 28 h</td><td></td></tr> <tr> <td>Group tutorial Mathematics M3e</td><td>1 SWS / 14 h</td><td></td></tr> </table>			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	
	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													

8.14 Mathematics M4e

Course name	Mathematics M4e	Exam number												
German name	Mathematik M4E	501328												
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	<table> <tr> <td></td><td>In class</td><td>Self-study</td></tr> <tr> <td>Lecture Mathematics M4e</td><td>3 SWS / 42 h</td><td>66 h</td></tr> <tr> <td>Global tutorial Mathematics M4e</td><td>2 SWS / 28 h</td><td></td></tr> <tr> <td>Group tutorial Mathematics M4e</td><td>1 SWS / 14 h</td><td></td></tr> </table>			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	
	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													