

2. Ordnung zur Änderung der studiengangsspezifischen

Prüfungsordnung

für den Masterstudiengang

Biomedical Engineering

der Rheinisch-Westfälischen Technischen Hochschule Aachen

vom 03.04.2018

(Prüfungsordnungsversion 2015)

Aufgrund der §§ 2 Abs. 4, 64 des Gesetzes über die Hochschulen des Landes Nordrhein-Westfalen (Hochschulgesetz – HG) in der Fassung der Bekanntmachung vom 16. September 2014 (GV. NRW S. 547), zuletzt geändert durch Artikel 3 des Gesetzes zur Sicherung der Akkreditierung von Studiengängen in Nordrhein-Westfalen vom 17. Oktober 2017 (GV. NRW S. 806), hat die Rheinisch-Westfälische Technische Hochschule Aachen (RWTH) folgende Prüfungsordnung erlassen:

Artikel I

Die studiengangspezifische Prüfungsordnung für den Masterstudiengang Biomedical Engineering der Rheinisch-Westfälischen Technischen Hochschule Aachen (RWTH) vom 28.07.2016 (Amtliche Bekanntmachungen der RWTH, Nr. 2016/081), zuletzt geändert durch die 1. Ordnung zur Änderung der studiengangspezifischen Prüfungsordnung vom 20.12.2016 (Amtliche Bekanntmachungen der RWTH, Nr. 2016/178), wird wie folgt geändert:

1. § 3 Absatz 2 wird durch die folgende Fassung ersetzt:

- (2) Für die fachliche Vorbildung ist es erforderlich, dass die Studienbewerberin bzw. der Studienbewerber in den nachfolgend aufgeführten Bereichen die für ein erfolgreiches Studium im Masterstudiengang Biomedical Engineering erforderlichen Kompetenzen nachweist:
- Insgesamt 90 CP aus dem ingenieurwissenschaftlichen und mathematisch-naturwissenschaftlichen Bereich.
 - Diese 90 CP müssen die in der folgenden Tabelle aufgelisteten Fächer im angegebenen Mindestumfang beinhalten.

Mathematik	Höhere Mathematik, u.a. Lineare Algebra (Vektor- und Tensorrechnung, Matrizen, Eigenwerte), Analysis (Serien, Differential- und Integralrechnung, Taylor-Entwicklung, Funktionen mehrerer Variablen, Fourier-Analyse, gewöhnliche und partielle Differentialgleichungen) numerische Methoden (Diskretisierung, direkte Lösungsmethoden für lineare Gleichungssysteme)	20 CP
Chemie	Höhere Chemie, u.a. anorg. Chemie, org. Chemie, Biochemie, Physikalischer Chemie, Polymerprocessing	20 CP
Biologie	Höhere Biologie, u.a. Humane Zellbiologie, Genetik, Mikrobiologie, Molekulare Biologie, Signalübertragung	20 CP
Physik & Ingenieurwesen	Höhere Physik, u.a. Mechanik, Elektrotechnik, Thermodynamik, Nuklearphysik, Festkörpermechanik, Statik und Dynamik	30 CP

Zusätzlich wird von allen Bewerbern der erfolgreiche Nachweis des Graduate Record Examination (GRE) General Test verlangt (nicht älter als zwei Jahre). Bewerbungen ohne GRE werden nicht berücksichtigt. Im quantitativen Teil dieses Tests müssen mindestens 160 Punkte erreicht werden. Studienbewerberinnen und -bewerber, die die Staatsangehörigkeit eines Mitgliedstaates der Europäischen Union oder des Europäischen Wirtschaftsraumes (EWR) besitzen, sowie Bildungsinländerinnen bzw. Bildungsinländer sind von dieser Regel ausgenommen.

2. § 3 Absatz 3 wird durch die folgende Fassung ersetzt:

- (3) Für die Zulassung in Verbindung mit einer Auflage gilt § 3 Abs. 6 ÜPO. Eine Zulassung zum Masterstudiengang Biomedical Engineering ist nicht möglich wenn:
- aufgrund der in Absatz 2 definierten fachlichen Grundlagen Auflagen im Umfang von mehr als 20 CP notwendig sind
 - in einem der Fächer mehr als 50% der dort nachzuweisenden CP fehlen.

3. § 7 Absatz 4 wird durch die folgende Fassung ersetzt:

- (4) Die Dauer einer mündlichen Prüfung beträgt mindestens 30 Minuten und höchstens 45 Minuten. Bei einer Gruppenprüfung beträgt die Prüfungsdauer mindestens 20 Minuten pro Kandidatin bzw. Kandidat. Eine mündliche Prüfung als Gruppenprüfung wird mit nicht mehr als vier Kandidatinnen bzw. Kandidaten durchgeführt.

4. § 7 Absatz 6 wird durch die folgende Fassung ersetzt:

- (6) Der Umfang der schriftlichen Ausarbeitung eines Referates beträgt ohne Referenzen/Anlagen 4 bis 8 Seiten. Die Dauer eines Referates beträgt mindestens 20 und höchstens 30 Minuten.

5. § 7 Absatz 8 wird durch die folgende Fassung ersetzt:

- (8) Für das 8-wöchige Praktikum (*Practical Experience/Internship*) gilt im Einzelnen Folgendes: Der Umfang des bewerteten Praktikumsberichts beträgt ohne Referenzen/Anlagen 20 Seiten.

6. § 13 Absatz 4 wird durch die folgende Fassung ersetzt:

- (4) Die Bearbeitungszeit für die Masterarbeit beträgt studienbegleitend mindestens vier Monate und höchstens sechs Monate. In begründeten Ausnahmefällen kann der Bearbeitungszeitraum auf Antrag an den Prüfungsausschuss nach Maßgabe des § 17 Abs. 7 ÜPO um maximal bis zu sechs Wochen verlängert werden. Die schriftliche Ausarbeitung sollte ohne Anlage 80 Seiten nicht überschreiten.

7. § 14 Absatz 2 wird durch die folgende Fassung ersetzt:

- (2) Die Masterarbeit ist fristgemäß in dreifacher Ausfertigung (vierfacher Ausfertigung für CE-MACUBE Studierende) beim Zentralen Prüfungsamt abzuliefern. Es sollen gedruckte und gebundene Exemplare eingereicht werden. Darüber hinaus ist die Arbeit auf einem Datenträger als PDF gespeichert abzugeben.

8. Ab dem Wintersemester 2017/2018 werden folgende Module nicht mehr angeboten:

- Porous Media Mechanics (6 CP)
- Selected Topics of Inelasticity Theory (6 CP)
- Special Aspects of Artificial Organs
- MATLAB Exercise

Für Studierende, die sich im schwebenden Prüfungsverfahren befinden, finden nach dem letzten Angebot der Lehrveranstaltung noch drei Prüfungstermine statt.

9. Ab dem Wintersemester 2017/2018 wird der Modulkatalog um folgende Module erweitert:

- Practical Course in Biochemical Neuroscience
- Porous Media Mechanics (5 CP)
- Selected Topics of Inelasticity Theory (5CP)
- Practical Course in Immunohistochemical Neuroscience

Die Modulbeschreibungen befinden sich in Anlage 1 dieser Änderungsordnung.

10. Ab dem Wintersemester 2017/2018 werden die Modulbeschreibungen der folgenden Module durch die entsprechenden Fassungen in Anlage 2 dieser Änderungsordnung ersetzt:

- Chemistry/Biochemistry
- Medical Biology
- Anatomy and Physiology
- Control and Electrical Engineering
- Biomedical Sensors and Microsystems
- Mechanics of living tissue
- Cell culture and Tissue Engineering
- Medical Statistics
- Neurosciences
- Immunology and Microbiology
- Bioinformatics
- Tensor Algebra and Tensor Analysis for Engineers I
- Mechanics/Biomechanics/Fluid Mechanics
- Medical Imaging

Für Studierende, die die nunmehr geänderten Module vor dem Wintersemester 2017/2018 begonnen haben, finden zu den bisherigen Bedingungen noch drei Prüfungstermine statt. Auf Antrag an den Prüfungsausschuss können die neuen Module gewählt werden.

11. Ab dem Sommersemester 2018 werden folgende Module nicht mehr angeboten:

- Ethics/Intellectual Property and Regulatory Affairs
- Optophysiology
- Experimental Medicine (Biom. Diagnostics)
- Methodical Design/ Project Management
- Intensive Care/Monitoring
- Seminar and Journal Club on Mol. Imaging

- Biomechanics and Mechanobiology for biological soft tissues
- Materials Science and Processing
- Hard Tissue Implants and Prostheses/Biomedical Research

Für Studierende, die sich im schwebenden Prüfungsverfahren befinden, finden nach dem letzten Angebot der Lehrveranstaltung noch drei Prüfungstermine statt.

12. Ab dem Sommersemester 2018 wird der Modulkatalog um folgende Module erweitert:

- MATLAB
- Ethics/Intellectual Property and Regulatory Affairs
- Optophysiology
- Experimental Medicine (Biom. Diagnostics)
- Methodical Design/ Project Management
- Intensive Care/Monitoring
- Seminar and Journal Club on Mol. Imaging
- Biomechanics and Mechanobiology for biological soft tissues
- Materials Science and Processing
- Advanced Biomaterials (Hard Tissue Implants and Prostheses & 3D Bioprinting)
- Selected Topics in regard to Artificial Organs

Die Modulbeschreibungen befinden sich in Anlage 1 dieser Änderungsordnung.

13. Ab dem Sommersemester 2018 werden die Modulbeschreibungen der folgenden Module durch die entsprechenden Fassungen in Anlage 2 dieser Änderungsordnung ersetzt:

- Practical Experience
- Continuum Mechanics

Für Studierende, die die nunmehr geänderten Module vor dem Sommersemester 2018 begonnen haben, finden zu den bisherigen Bedingungen noch drei Prüfungstermine statt. Auf Antrag an den Prüfungsausschuss können die neuen Module gewählt werden.

Ab dem Wintersemester 2018/2019 werden folgende Module nicht mehr angeboten:

- Image guided Therapy/Molecular Imaging
- Artificial Organs I
- Artificial Organs II
- Image Processing and Handling

Für Studierende, die sich im schwebenden Prüfungsverfahren befinden, finden nach dem letzten Angebot der Lehrveranstaltung noch drei Prüfungstermine statt.

14. Ab dem Wintersemester 2018/19 wird der Modulkatalog um folgende Module erweitert:

- Image guided Therapy/Molecular Imaging
- Artificial Organs I
- Artificial Organs II
- Image Processing and Handling

Die Modulbeschreibungen befinden sich in Anlage 1 dieser Änderungsordnung.

15. Ab dem Wintersemester 2018/2019 wird die Modulbeschreibung des folgenden Moduls durch die entsprechende Fassung in Anlage 2 dieser Änderungsordnung ersetzt:

- Systems Biology

Für Studierende, die das nunmehr geänderte Modul vor dem Wintersemester 2018/2019 begonnen haben, finden zu den bisherigen Bedingungen noch drei Prüfungstermine statt. Auf Antrag an den Prüfungsausschuss kann das neue Modul gewählt werden.

16. Ab dem Wintersemester 2017/2018 wird der Studienverlaufsplan durch die entsprechende Fassung in Anlage 3 dieser Änderungsordnung ersetzt.

Artikel II

Diese Änderungsordnung wird in den Amtlichen Bekanntmachungen der RWTH veröffentlicht, tritt am Tage nach ihrer Veröffentlichung in Kraft und findet auf alle in den Masterstudiengang Biomedical Engineering (Prüfungsordnungsversion 2015) eingeschriebenen Studierenden Anwendung.

Ausgefertigt aufgrund der Beschlüsse des Fakultätsrates der Medizinischen Fakultät vom 10.07.2017 und vom 29.01.2018.

Für den Rektor
der Rheinisch-Westfälischen
Technischen Hochschule Aachen
Der Kanzler

Aachen, den 03.04.2018

gez. Nettekoven
Manfred Nettekoven

Anlage 1: Neue Module

Modul: Practical Course in Biochemical Neuroscience [MSBME-503/2015]

MODUL TITEL: Practical Course in Biochemical Neuroscience					
Fachsemester	1	Kreditpunkte	3	Sprache	English
Titel	Curriculare Verankerung		Fachsemester	CP	SWS
Seminar "Practical Course in Biochemical Neuroscience" [MSBME-503e/2015]	Freiwillige Leistung		1	0	1
Practical Course "Practical Course in Biochemical Neuroscience" [MSBME-503b/2015]	Freiwillige Leistung		1	0	1
Exam Seminar "Practical Course in Biochemical Neuroscience"[MSBME_503.d/2015]	Freiwillige Leistung		1	3	0
Voraussetzungen			Benotung/Dauer		
<p>An overview article for principles of Western blotting and basic molecular biological techniques will be circulated to all students for self study prior to the introductory seminar. Examples of publications will also be circulated for the seminar discussion in which biochemical and molecular techniques are applied for research. Each student will prepare and present a paper for discussion.</p> <p>Each student will also prepare a 15-20 minute power-point presentation on one of a range of neuroanatomical subjects proposed by Dr. Goswami.</p> <p>Attendance at the seminars and practicals are compulsory. Only 10% absence for the practical course and 30 % for the seminar – including absence with medical certificate – is acceptable for the compulsory parts.</p> <p>At the end of the course each student will write a practical summary from one of the above topics with app. 800 words (2,5 pages) with max. 10 references.</p> <p>Due to limitations of space, the course will be restricted to a maximum of 4-5 students per group, with a maximum of 2 groups per semester.</p>			<p>This optional course is not subject to grading and will only be marked as "passed" on the Master's certificate. It will only be listed on your Master's certificate if explicitly applied for (see § 8 (3) ÜPO).</p>		

Modul: Porous Media Mechanics [MSBME-512 /2015]

MODUL TITEL: Porous Media Mechanics					
Fachsemester	2	Kreditpunkte	5	Sprache	English
Titel	Curriculare Verankerung		Fachsemester	CP	SWS
Lecture Porous Media Mechanics [MSBME-512 a/2015]	Freiwillige Leistung		2	0	2
Exercise Porous Media Mechanics [MSBME-512 b/2015]	Freiwillige Leistung		2	0	2
Exam Porous Media Mechanics [MSBME-512 d/2015]	Freiwillige Leistung		2	5	0
Voraussetzungen			Benotung/Dauer		
<p>Basic knowledge in Mathematics. Successfully passed module Mechanics/Biomechanics/ Fluid Mechanics from the 1st semester.</p> <p>Recommended:</p> <ul style="list-style-type: none"> - Continuum Mechanics (Prof. Itskov) - Selected topics of Inelasticity Theory (Prof. Markert) <p>Attendance at the lectures is voluntary, but attendance at the exercises is compulsory.</p> <p>Only 10% absence – including absence with medical certificate – is acceptable for the compulsory parts.</p> <p>The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>Written exam, duration 90-120 min, or oral exam of 30 min. A minimum score of usually 50% is required to pass. The mark of the module is the mark of the exam.</p> <p>This optional course is subject to grading, but the results do not influence the overall grading on your Master's certificate. It will only be listed on your Master's certificate if explicitly applied for (see § 8 (3) ÜPO).</p>		

Modul: Selected Topics of Inelasticity Theory [MSBME-513/2015]

MODUL TITEL: Selected Topics of Inelasticity Theory					
Fachsemester	1	Kreditpunkte	5	Sprache	English
Titel	Curriculare Verankerung		Fachsemester	CP	SWS
Lecture "Selected Topics of Inelasticity Theory" [MSBME-513 a/2015]	Freiwillige Leistung		1	0	2
Exercise: "Selected Topics of Inelasticity Theory" [MSBME-513 b/2015]	Freiwillige Leistung		1	0	2
Exam "Selected Topics of Inelasticity Theory" [MSBME-513 d/2015]	Freiwillige Leistung		1	5	0
Voraussetzungen			Benotung/Dauer		
<p>Basic knowledge in Mathematics as described in the application regulations. Successfully passed module Mechanics/Biomechanics/Fluid Mechanics from the 1st semester.</p> <p>Attendance at the lectures is voluntary, but attendance at the exercises is compulsory. Only 10% absence – including absence with medical certificate – is acceptable for the compulsory parts. The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>Written exam, duration 90-120 min, or oral exam of 30 min. A minimum score of usually 50% is required to pass. The mark of the module is the mark of the exam.</p> <p>This optional course is subject to grading, but the results do not influence the overall grading on your Master's certificate. It will only be listed on your Master's certificate if explicitly applied for (see § 8 (3) ÜPO).</p>		

Modul: Selected Topics in regard to Artificial Organs [MSBME-501/2015]

MODUL TITEL: Selected Topics in regard to Artificial Organs					
Fachsemester	2	Kreditpunkte	2	Sprache	English
Titel	Curriculare Verankerung		Fachsemester	CP	SWS
Seminar "Selected topics in regard to Artificial Organs" [MSBME-501e/2015]	Freiwillige Leistung		2	0	1
Exam "Selected topics in regard to Artificial Organs" [MSBME-501.d/2015]	Freiwillige Leistung		2	2	0
Voraussetzungen			Benotung/Dauer		
<p>Successfully passed module Anatomy/Physiology and Chemistry/Biochemistry from 1st semester</p> <p>Attendance at the seminars is compulsory. Only 30% absence – including absence with medical certificate – is acceptable.</p>			<p>This optional course is not subject to grading and will only be marked as "passed" on the Master's certificate if explicitly applied for (see § 8 (3) ÜPO).</p>		

Modul: Advanced Biomaterials (Hard Tissue Implants and Prostheses & 3D Bioprinting) [MSBME-502/2015]

MODUL TITEL: Advanced Biomaterials (Hard Tissue Implants and Prostheses & 3D Bioprinting)						
Fachsemester	2	Kreditpunkte	5	Sprache	English	
Titel			Curriculare Verankerung	Fachsemester	CP	SWS
Seminar "Advanced Biomaterials" [MSBME-502 e/2015]			Semesterfixierte Wahlpflichtleistung	2	0	2
Practical Course "Advanced Biomaterials" [MSBME-502 b/2015]			Semesterfixierte Wahlpflichtleistung	2	0	1
Exam: "Advanced Biomaterials" [MSBME-502 d/2015]			Semesterfixierte Wahlpflichtleistung	2	5	0
Voraussetzungen			Benotung/Dauer			
<p>Successfully passed modules Medical Biology and Chemistry/Biochemistry from 1st semester Knowledge in Mathematics, Physics.</p> <p>Attendance at the seminars and practical courses are compulsory.</p> <p>Only 10% absence for the practical course and 30 % for the seminar – including absence with medical certificate – is acceptable for the compulsory parts. The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>Written exam, duration 90-120 min, or oral exam duration of 30 min.</p> <p>A minimum score of usually 50% is required to pass.</p> <p>The mark of the module is the mark of the exam.</p>			

Modul: Practical Course in Immunohistochemical Neuroscience [MSBME-504/2015]

MODUL TITEL: Practical Course in Immunohistochemical Neuroscience						
Fachsemester	1	Kreditpunkte	3	Sprache	English	
Titel			Curriculare Verankerung	Fachsemester	CP	SWS
Seminar "Practical Course in Immunohistochemical Neuroscience" [MSBME-504 e/2015]			Freiwillige Leistung	1	0	1
Practical Course "Practical Course in Immunohistochemical Neuroscience" [MSBME-504 b/2015]			Freiwillige Leistung	1	0	1
Exam Practical Course in Immunohistochemical Neuroscience" [MSBME-504 d/2015]			Freiwillige Leistung	1	3	0
Voraussetzungen			Benotung/Dauer			
<p>An overview article for principles of immunohistochemistry will be circulated to all students for self study prior to the introductory seminar.</p> <p>Examples of publications will also be circulated for the seminar discussion in which immunohistochemistry is applied for research. Each student will prepare and present a paper for discussion.</p> <p>Each student will also prepare a 15-20 minute power-point presentation on one of a range of neuroanatomical subjects proposed by Dr. Brook.</p> <p>Attendance at the seminars and practicals are compulsory</p> <p>Only 10% absence for the practical course and 30 % for the seminar – including absence with medical certificate – is acceptable for the compulsory parts.</p> <p>Due to limitations of space, the course will be restricted to a maximum of 2-3 students per group, with a maximum of 2 groups per semester.</p>			<p>This optional course is not subject to grading and will only be marked as "passed" on the Master's certificate.</p> <p>It will only be listed on your Master's certificate if explicitly applied for (see § 8 (3) ÜPO).</p>			

Modul: MATLAB [MSBME-505/2015]

MODUL TITEL: MATLAB						
Fachsemester	2	Kreditpunkte	5	Sprache	English	
Titel			Curriculare Verankerung	Fachsemester	CP	SWS
Lecture MATLAB: [MSBME-505 a/2015]			Freiwillige Leistung	2	0	1
Exercise: MATLAB [MSBME-505 b/2015]			Freiwillige Leistung	2	0	2
Exam: MATLAB : : [MSBME-505 d/2015]			Freiwillige Leistung	2	5	0
Voraussetzungen			Benotung/Dauer			
<p>Basic Knowledge of mathematics, handling computer tools. Attendance at the lecture is voluntary but attendance at the exercise is compulsory.</p> <p>Only 10% absence – including absence with medical certificate – is acceptable for the compulsory parts.</p> <p>The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>Written exam, duration 90-120 min, or oral exam duration of 30 min. A minimum score of usually 50% is required to pass. The mark of the module is the mark of the exam.</p> <p>This optional course is not subject to grading and will only be marked as "passed" on the Master's certificate. It will only be listed on your Master's certificate if explicitly applied for (see § 8 (3) ÜPO).</p>			

Modul: Ethics/Intellectual Property and Regulatory Affairs [MSBME-506/2015]

MODUL TITEL: Ethics/Intellectual Property and Regulatory Affairs						
Fachsemester	2	Kreditpunkte	5	Sprache	English	
Titel			Curriculare Verankerung	Fachsemester	CP	SWS
Seminar "Ethics/Intellectual Property and Regulatory Affairs" [MSBME-506.e/2015]			Semesterfixierte Pflichtleistung	2	0	2
Practical Course "Ethics/Intellectual Property and Regulatory Affairs" [MSBME-506.c/2015]			Semesterfixierte Pflichtleistung	2	0	1
Exam "Ethics/Intellectual Property and Regulatory Affairs" [MSBME-506.d/2015]			Semesterfixierte Pflichtleistung	2	5	0
Voraussetzungen			Benotung/Dauer			
<p>Successfully passed the module Medical Biology and Chemistry/Biochemistry in the 1st semester. Attendance at the practical courses and seminar are compulsory.</p> <p>Only 10% absence for the practical course and 30 % for the seminar – including absence with medical certificate – is acceptable for the compulsory parts.</p> <p>The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>Written Exam. Duration for three exams 90-120 min (Ethics, Intellectual Property and Regulatory Affairs), A minimum score of usually 50% in each exam is required to pass.</p> <p>The mark of the module is the average of the respective marks awarded in each exam. Each exam has to be passed separately and will be equally considered.</p> <p>In case of a partial exam failure, only the failed exam will have to be repeated.</p>			

Modul: Optophysiology [MSBME-519/2015]

MODUL TITEL: Optophysiology						
Fachsemester	2	Kreditpunkte	5	Sprache	English	
Titel			Curriculare Verankerung	Fachsemester	CP	SWS
Lecture "Optophysiology" [MSBME-519 a/2015]			Semesterfixierte Wahlpflichtleistung	2	0	2
Seminar "Optophysiology" [MSBME-519 e/2015]			Semesterfixierte Wahlpflichtleistung	2	0	1
Exam "Optophysiology" [MSBME-519 d/2015]			Semesterfixierte Wahlpflichtleistung	2	5	0
Voraussetzungen			Benotung/Dauer			
<p>Successfully passed modules Anatomy/Physiology from 1st semester.</p> <p>Attendance at the lectures is voluntary, but attendance at the seminar is compulsory.</p> <p>Only 30% absence – including absence with medical certificate – is acceptable for the compulsory parts.</p> <p>For exercises frequent attendance, protocol and oral presentation are requested.</p> <p>The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>Written Exam. Duration 90-120min.</p> <p>A minimum score of usually 50% is required to pass.</p> <p>The mark of the module is the mark of the exam.</p>			

Modul: Methodical Design/ Project Management [MSBME-515/2015]

MODUL TITEL: Methodical Design/ Project Management						
Fachsemester	2	Kreditpunkte	5	Sprache	English	
Titel			Curriculare Verankerung	Fachsemester	CP	SWS
Seminar "Methodical Design" [MSBME-515e/2015]			Semesterfixierte Wahlpflichtleistung	2	0	1
Practical Course "Methodical Design" [MSBME-515 c/2015]			Semesterfixierte Wahlpflichtleistung	2	0	2
Exam "Methodical Design" [MSBME-515 d/2015]			Semesterfixierte Wahlpflichtleistung	2	5	0
Voraussetzungen			Benotung/Dauer			
<p>Attendance at the seminar and practical parts are compulsory.</p> <p>Only 10% absence for the practical course and 30 % for the seminar – including absence with medical certificate – is acceptable for the compulsory parts. The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>The mark of the module consists of the mark of the written report (33%), the presentation (33%) and the performance during the assignment (34%).</p>			

Modul: Intensive Care/Monitoring [MSBME-516/2015]

MODUL TITEL: Intensive Care/Monitoring						
Fachsemester	2	Kreditpunkte	2	Sprache	English	
Titel			Curriculare Verankerung	Fachsemester	CP	SWS
Seminar "Intensive Care/Monitoring" [MSBME-516.e/2015]			Freiwillige Leistung	2	0	0.5
Practical Course "Intensive Care/ Monitoring" [MSBME-516.c/2015]			Freiwillige Leistung	2	0	0.5
Exam "Intensive Care Monitoring [MSBME-516 d/2015]			Freiwillige Leistung	2	2	0
Voraussetzungen			Benotung/Dauer			
Attendance at the seminar and practical courses are compulsory. Only 10% absence for the practical course and 30 % for the seminar – including absence with medical certificate – is acceptable for the compulsory parts.			This optional course is not subject to grading and will only be marked as "passed" on the Master's certificate. It will only be listed on your Master's certificate if explicitly applied for (see § 8 (3) ÜPO).			

Modul: Seminar and Journal Club on Mol. Imaging [MSBME-517/2015]

MODUL TITEL: Seminar and Journal Club on Mol. Imaging						
Fachsemester	2	Kreditpunkte	3	Sprache	English	
Titel			Curriculare Verankerung	Fachsemester	CP	SWS
Seminar "Seminar and Journal Club on Mol. Imaging" [MSBME-517 e/2015]			Freiwillige Leistung	2	0	2
Exam "Seminar and Journal Cclub on Mol. Imaging [MSBME-517 d/2015]			Freiwillige Leistung	2	3	0
Voraussetzungen			Benotung/Dauer			
Attendance at the seminar is compulsory. Only 30% absence – including absence with medical certificate – is acceptable for the compulsory parts.			This optional course is not subject to grading and will only be marked as "passed" on the Master's certificate. It will only be listed on your Master's certificate if explicitly applied for (see § 8 (3) ÜPO).			

Modul: Biomechanics and Mechanobiology for biological soft tissues [MSBME-518/2015]

MODUL TITEL: Biomechanics and Mechanobiology for biological soft tissues					
Fachsemester	2	Kreditpunkte	5	Sprache	English
Titel	Curriculare Verankerung		Fachsemester	CP	SWS
Lecture "Biomechanics and Mechanobiology for soft biol. tissues" [MSBME-518 a/2015]	Semesterfixierte Wahlpflichtleistung		2	0	1
Exercise "Biomechanics and Mechanobiology for soft biol. tissues" [MSBME-518 b/2015]	Semesterfixierte Wahlpflichtleistung		2	0	1
Exam: "Biomechanics and Mechanobiology for soft biol. tissues" [MSBME-518 d/2015]	Semesterfixierte Wahlpflichtleistung		2	5	0
Voraussetzungen			Benotung/Dauer		
<p>Successfully passed the module Mechanics/Biomechanics/ Fluid Mechanics of the 1st semester. Attendance at the lectures is voluntary, but attendance at the exercises is compulsory. Only 10% absence – including absence with medical certificate – is acceptable for the compulsory parts. The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>Written Exam. Duration 90-120min. A minimum score of usually 50% is required to pass. The mark of the module is the mark of the exam.</p>		

Modul: Materials Science and Processing [MSBME-514/2015]

MODUL TITEL: Materials Science and Processing					
Fachsemester	2	Kreditpunkte	5	Sprache	English
Titel	Curriculare Verankerung		Fachsemester	CP	SWS
Lecture "Materials Science and Processing" [MSBME-514.a/2015]	Semesterfixierte Pflichtleistung		2	0	3
Exercise "Materials Science and Processing" [MSBME-514.b/2015]	Semesterfixierte Pflichtleistung		2	0	1
Exam "Materials Science and Processing" [MSBME-514.d/2015]	Semesterfixierte Pflichtleistung		2	5	0
Voraussetzungen			Benotung/Dauer		
<p>Succesfully passed the module Chemistry/Biochemistry in the first semester. Attendance at the lectures is voluntary, but attendance at the exercises is compulsory. Only 10% absence – including absence with medical certificate – is acceptable for the compulsory parts. The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>Written Exam. Duration: 90-120min, A minimum score of usually 50% is required to pass. The mark of the module is the mark of the exam.</p>		

Modul: Image Guided Therapy/Molecular Imaging [MSBME-507/2015]

MODUL TITEL: Image Guided Therapy/Molecular Imaging					
Fachsemester	3	Kreditpunkte	5	Sprache	English
Titel	Curriculare Verankerung		Fachsemester	CP	SWS
Lecture "Image Guided Therapy/Molecular Imaging" [MSBME-507.a/2015]	Semesterfixierte	Pflichtleistung	3	0	2
Practical Course "Image Guided Therapy/Molecular Imaging" [MSBME-507.b/2015]	Semesterfixierte	Pflichtleistung	3	0	0.5
Exercise "Image Guided Therapy/Molecular Imaging" [MSBME-507.c/2015]	Semesterfixierte	Pflichtleistung	3	0	0.5
Exam "Image Guided Therapy/Molecular Imaging" [MSBME-507.d/2015]	Semesterfixierte	Pflichtleistung	3	5	0
Voraussetzungen			Benotung/Dauer		
<p>Successfully passed module Medical Biology and Anatomy /Physiology from 1st semester and the module Medical Imaging from 2nd semester</p> <p>Attendance at the exercises and practical courses are compulsory. Only 10% absence – including absence with medical certificate – is acceptable for the compulsory parts. The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>Written exam. Duration 90-120 minutes or oral exam duration of 30 min., A minimum score of usually 50% is required to pass. The mark of the module is the mark of the exam.</p>		

Modul: Artificial Organs I [MSBME-509/2015]

MODUL TITEL: Artificial Organs I					
Fachsemester	3	Kreditpunkte	5	Sprache	English
Titel	Curriculare Verankerung		Fachsemester	CP	SWS
Lecture "Artificial Organs I" [MSBME-509.a/2015]	Semesterfixierte	Pflichtleistung	3	0	2
Practical Course "Artificial Organs I" [MSBME-509.c/2015]	Semesterfixierte	Pflichtleistung	3	0	1
Exam "Artificial Organs I" [MSBME-509.d/2015]	Semesterfixierte	Pflichtleistung	3	5	0
Voraussetzungen			Benotung/Dauer		
<p>Successfully passed the modules Anatomy/Physiology and Chemistry/Biochemistry from 1st semester.</p> <p>Attendance at the lectures is voluntary, but attendance at the practical courses is compulsory. Only 10% absence – including absence with medical certificate – is acceptable for the compulsory parts. The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>Written exam. Duration 90-120 minutes, A minimum score of usually 50% is required to pass. The mark of the module is the mark of the exam.</p>		

Modul: Artificial Organs II [MSBME-510/2015]

MODUL TITEL: Artificial Organs II					
Fachsemester	3	Kreditpunkte	5	Sprache	English
Titel	Curriculare Verankerung		Fachsemester	CP	SWS
Lecture "Artificial Organs II" [MSBME-510.a/2015]	Semesterfixierte	Pflichtleistung	3	0	2
Practical Course "Artificial Organs II" [MSBME-510.c/2015]	Semesterfixierte	Pflichtleistung	3	0	1
Exam "Artificial Organs II" [MSBME-510.d/2015]	Semesterfixierte	Pflichtleistung	3	5	0
Voraussetzungen			Benotung/Dauer		
<p>Successfully passed the modules Anatomy/Physiology and Chemistry/Biochemistry from 1st semester.</p> <p>Attendance at the lectures is voluntary, but attendance at the practical courses is compulsory. Only 10% absence – including absence with medical certificate – is acceptable for the compulsory parts. The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>Written exam. Duration 90-120 minutes, A minimum score of usually 50% is required to pass. The mark of the module is the mark of the exam.</p>		

Modul: Image Processing and Handling [MSBME-508/2015]

MODUL TITEL: Image Processing and Handling					
Fachsemester	3	Kreditpunkte	5	Sprache	English
Titel	Curriculare Verankerung		Fachsemester	CP	SWS
Lecture "Image Processing and Handling" [MSBME-508.a/2015]	Semesterfixierte	Pflichtleistung	3	0	2
Exercise "Image Processing and Handling" [MSBME-508.b/2015]	Semesterfixierte	Pflichtleistung	3	0	1
Exam "Image Processing and Handling" [MSBME-508.d/2015]	Semesterfixierte	Pflichtleistung	3	5	0
Voraussetzungen			Benotung/Dauer		
<p>Successfully passed the module Medical Imaging from 2nd semester. Knowledge in mathematics, physics, and computer sciences.</p> <p>Attendance at the lectures is voluntary but attendance at the exercises is compulsory. Only 10 % absence - including absence with medical certificate - will be accepted for the compulsory parts.</p> <p>The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>Written exam, duration 90-120 min, or oral exam duration of 30 min. A minimum score of usually 50% is required to pass. The mark of the module is the mark of the exam.</p>		

Modul: Experimental Medicine (Biom. Diagnostics) [MSBME-520/2015]

MODUL TITEL: Experimental Medicine (Biom. Diagnostics)						
Fachsemester	2	Kreditpunkte	5	Sprache	English	
Titel			Curriculare Verankerung	Fachsemester	CP	SWS
Seminar "Experimental Medicine" [MSBME-520.e/2015]			Semesterfixierte Wahlpflichtleistung	2	0	2
Exercise "Experimental Medicine" [MSBME-520.b/2015]			Semesterfixierte Wahlpflichtleistung	2	0	1
Exam "Experimental Medicine" [MSBME-520.d/2015]			Semesterfixierte Wahlpflichtleistung	2	5	0
Voraussetzungen			Benotung/Dauer			
<p>Successfully passed the modules Anatomy/Physiology and Medical Biology from the 1st semester.</p> <p>Attendance at the seminars and exercises are compulsory. Only 10% absence for the exercise and 30 % for the seminar – including absence with medical certificate – is acceptable for the compulsory parts. The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>Written Exam. Duration 90-120min. A minimum score of usually 50% is required to pass. The mark of the module is the mark of the exam.</p>			

Anlage 2: Geänderte Modulbeschreibungen

Modul: Chemistry/Biochemistry [MSBME-1010/2015]

MODUL TITEL: Chemistry/Biochemistry						
Fachsemester	1	Kreditpunkte	5	Sprache	English	
Titel			Curriculare Verankerung	Fachsemester	CP	SWS
Lecture: Chemistry/ Biochemistry [MSBME-1010.a/2015]			Semesterfixierte Pflichtleistung	1	0	2
Practical Course: Chemistry-Biochemistry [MSBME-1010.c/2015]			Semesterfixierte Pflichtleistung	1	0	1
Exam: Chemistry/Biochemistry [MSBME-1010.d/2015]			Semesterfixierte Pflichtleistung	1	5	0
Voraussetzungen			Benotung/Dauer			
<p>Basic knowledge in Chemistry and Biochemistry</p> <p>Attendance at the lectures is voluntary, but attendance at the practical courses is compulsory.</p> <p>Only 10% absence – including absence with medical certificate – is acceptable for the compulsory parts. The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>Written Exam. Duration for both exams 90-120 min (Chemistry and Biochemistry).</p> <p>A minimum score of usually 50% in each exam is required to pass.</p> <p>The mark of the module is the average of the respective marks awarded in both exams. Each exam has to be passed separately and will be equally considered.</p> <p>In case of a partial exam failure, only the failed exam will have to be repeated.</p>			

Modul: Medical Biology [MSBME-1020/2015]

MODUL TITEL: Medical Biology						
Fachsemester	1	Kreditpunkte	5	Sprache	English	
Titel			Curriculare Verankerung	Fachsemester	CP	SWS
Lecture Medical Biology [MSBME-1020.a/2015]			Semesterfixierte Pflichtleistung	1	0	2
Practical Course Medical Biology [MSBME-1020.c/2015]			Semesterfixierte Pflichtleistung	1	0	1
Exam Medical Biology [MSBME-1020.d/2015]			Semesterfixierte Pflichtleistung	1	5	0
Voraussetzungen			Benotung/Dauer			
<p>General understanding of Molecular and Cellular Biology.</p> <p>Attendance at the lectures is voluntary, but attendance at the practical courses is compulsory.</p> <p>Only 10% absence – including absence with medical certificate – is acceptable for the compulsory parts. The exam can only be attended if the compulsory parts have been fulfilled</p>			<p>Written Exam. Duration 90-120 min.</p> <p>A minimum score of usually 50% is required to pass.</p> <p>The grade for the module is composed of the exam score.</p>			

Modul: Anatomy and Physiology [MSBME-1030/2015]

MODUL TITEL: Anatomy and Physiology						
Fachsemester	1	Kreditpunkte	5	Sprache	English	
Titel			Curriculare Verankerung	Fachsemester	CP	SWS
Lecture: Anatomy- Physiology [MSBME-1030.a/2015]			Semesterfixierte Pflichtleistung	1	0	2
Exercise: Anatomy-Physiology [MSBME-1030b/2015]			Semesterfixierte Pflichtleistung	1	0	1
Practical Course: Anatomy-Physiology [MSBME-1030.c/2015]			Semesterfixierte Pflichtleistung	1	0	1
Exam: Anatomy-Physiology [MSBME-1030.d/2015]			Semesterfixierte Pflichtleistung	1	5	0
Voraussetzungen			Benotung/Dauer			
<p>Knowledge in Physics and Chemistry</p> <p>Attendance at the lectures is voluntary, but attendance at the practical courses and exercise are compulsory. Only 10% absence – including absence with medical certificate – is acceptable for the compulsory parts. The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>Written Exam. Duration for both exams 90-120 minutes (Anatomy and Physiology). A minimum score of usually 50% in each exam is required to pass. The grade for the Anatomy exam consists of the written exam score (95%) and a 5-10 min. practical (microscopy) test (5%). The grade for the Physiology exam is composed of the exam score. The mark of the module is the average of the respective marks awarded in both exams. Each exam has to be passed separately and will be equally considered. In case of a partial exam failure, only the failed part will have to be repeated.</p>			

Modul: Control and Electrical Engineering [MSBME-1050/2015]

MODUL TITEL: Control and Electrical Engineering					
Fachsemester	1	Kreditpunkte	5	Sprache	English
Titel	Curriculare Verankerung		Fachsemester	CP	SWS
Lecture: Control and Electrical Engineering [MSBME-1050.a/2015]	Semesterfixierte Pflichtleistung		1	0	2
Exercise: Control and Electrical Engineering [MSBME-1050.b/2015]	Semesterfixierte Pflichtleistung		1	0	2
Exam: Control and Electrical Engineering [MSBME-1050.d/2015]	Semesterfixierte Pflichtleistung		1	5	0
Voraussetzungen			Benotung/Dauer		
<p>Electrical Eng: Basic knowledge in mathematics: Knowledge in electrical engineering about: electrical charges, electrical current, electrical fields and potentials, resistors, capacitors and inductances; current and voltage sources, electrical networks, alternating current and complex impedances and their application to electrical circuits, semiconductors like diodes or bipolar junction transistors, switching logic and switching circuits as well as in electrical safety.</p> <p>Control Eng: Basic knowledge in mathematics and system theory: ordinary differential equations, functional diagram, linearization, laplace transform, transfer function, linear control loop elements.</p> <p>Attendance at the lectures is voluntary but attendance at the exercises is compulsory. Only 10% absence – including absence with medical certificate – is acceptable for the compulsory parts. The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>Written Exam. Duration for both exams 90-120 min (Control Engineering and Electrical Engineering) - (alternatively individual oral exam of 30 min for each exam), A minimum score of usually 50% in each exam is required to pass. The mark of the module is the average of the respective marks awarded in each exam. Each exam has to be passed separately and will be equally considered. In case of a partial exam failure, only the failed exam will have to be repeated.</p>		

Modul: Medical Imaging [MSBME-205/2015]

MODUL TITEL: Medical Imaging					
Fachsemester	2	Kreditpunkte	5	Sprache	English
Titel	Curriculare Verankerung		Fachsemester	CP	SWS
Lecture "Medical Imaging" [MSBME-205.a/2015]	Semesterfixierte Pflichtleistung		2	0	2
Practical Course "Medical Imaging" [MSBME-205.c/2015]	Semesterfixierte Pflichtleistung		2	0	2
Exam "Medical Imaging" [MSBME-205.d/2015]	Semesterfixierte Pflichtleistung		2	5	0
Voraussetzungen			Benotung/Dauer		
<p>Successfully passed the module Anatomy/Physiology in the 1st semester.</p> <p>Attendance at the lectures is voluntary, but attendance at the practical courses is compulsory. Only 10% absence – including absence with medical certificate – is acceptable for the compulsory parts. The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>Written Exam. Duration 90-120min. A minimum score of usually 50% is required to pass. The mark of the module is the mark of the exam.</p>		

Modul: Practical Experience [MSBME-107/2015]

MODUL TITEL: Practical Experience						
Fachsemester	2	Kreditpunkte	10	Sprache	English	
Titel			Curriculare Verankerung	Fachsemester	CP	SWS
Internship [MSBME-107.c/2015]			Semesterfixierte Pflichtleistung	2	0	20
Internship Report [MSBME-107.d/2015]			Semesterfixierte Pflichtleistung	2	10	0
Voraussetzungen			Benotung/Dauer			
<p>Successfully passed all mandatory modules (30 credits) in the 1st semester.</p>			<p>A report of 20 pages (excluding references) should be written, and an attendance letter of the supervisor has to be added. The practical experience will be supervised by a lecturer of the BME program and a partner university or an external supervisor from a BME related company/institution. Both supervisors are required to grade the Internship. For further information see document: Internship guidelines.</p>			

Modul: Medical Statistics [MSBME-114/2015]

MODUL TITEL: Medical Statistics						
Fachsemester	1	Kreditpunkte	5	Sprache	English	
Titel			Curriculare Verankerung	Fachsemester	CP	SWS
Lecture "Medical Statistics" [MSBME-114.a/2015]			Semesterfixierte Wahlpflichtleistung	1	0	2
Exercise "Medical Statistics" [MSBME-114.b/2015]			Semesterfixierte Wahlpflichtleistung	1	0	2
Exam "Medical Statistics" [MSBME-114.d/2015]			Semesterfixierte Wahlpflichtleistung	1	5	0
Voraussetzungen			Benotung/Dauer			
<p>Basic knowledge in elementary statistics is required. In particular data description as well as basics of probability theory and distribution of data (normal theory) should be acquainted.</p> <p>Attendance at the lectures is voluntary, but attendance at the exercises is compulsory. Only 10% absence – including absence with medical certificate – is acceptable for the compulsory parts. The exam can only be attended if the compulsory parts have been fulfilled.</p> <p>The exercises include weekly homework, which can be solved in groups up to 4 students. The homework is rated by points and includes SAS or R exercises.</p>			<p>Written Exam. Duration 60-90 min, A minimum score of usually 50% is required to pass. The mark of the module is the mark of the exam.</p>			

Modul: Biomedical Sensors and Microsystems [MSBME-112/2015]

MODUL TITEL: Biomedical Sensors and Microsystems						
Fachsemester	1	Kreditpunkte	5	Sprache	English	
Titel			Curriculare Verankerung	Fachsemester	CP	SWS
Lecture "Biomedical Sensors and Microsystems" [MSBME-112.a/2015]			Semesterfixierte Wahlpflichtleistung	1	0	2
Exercise "Biomedical Sensors and Microsystems" [MSBME-112.b/2015]			Semesterfixierte Wahlpflichtleistung	1	0	1
Exam "Biomedical Sensors and Microsystems" [MSBME-112.d/2015]			Semesterfixierte Wahlpflichtleistung	1	5	0
Voraussetzungen			Benotung/Dauer			
Attendance at the lectures is voluntary, but attendance at the exercises is compulsory. Only 10% absence – including absence with medical certificate – is acceptable for the compulsory parts. The exam can only be attended if the compulsory parts have been fulfilled.			Written Exam. Duration: 90-120 min. A minimum score of usually 50% is required to pass. The mark of the module is the mark of the exam.			

Modul: Mechanics of living tissue [MSBME-113/2015]

MODUL TITEL: Mechanics of living tissue						
Fachsemester	1	Kreditpunkte	5	Sprache	English	
Titel			Curriculare Verankerung	Fachsemester	CP	SWS
Lecture "Mechanics of living tissue" [MSBME-113.a/2015]			Semesterfixierte Wahlpflichtleistung	1	0	2
Exercise "Mechanics of living tissue" [MSBME-113.b/2015]			Semesterfixierte Wahlpflichtleistung	1	0	2
Exam "Mechanics of living tissue" [MSBME-113.d/2015]			Semesterfixierte Wahlpflichtleistung	1	5	0
Voraussetzungen			Benotung/Dauer			
Basic knowledge in Mathematics. Attendance at the lectures is voluntary, but attendance at the exercises is compulsory. Only 10% absence – including absence with medical certificate – is acceptable for the compulsory parts. The exam can only be attended if the compulsory parts have been fulfilled.			Oral Exam. Duration: 30 min The mark of the module is the mark of the exam.			

Modul: Neurosciences [MSBME-511/2015]

MODUL TITEL: Neurosciences						
Fachsemester	1	Kreditpunkte	2	Sprache	English	
Titel			Curriculare Verankerung	Fachsemester	CP	SWS
Seminar "Neurosciences" [MSBME-511 e/2015]			Freiwillige Leistung	1	0	1
Exam Seminar Neurosciences [MSBME-511.d/2015]			Freiwillige Leistung	1	2	0
Voraussetzungen			Benotung/Dauer			
<p>A recent review article for each topic will be circulated to all students prior to lectures being given.</p> <p>Attendance at the seminars is compulsory.</p> <p>Only 30% absence – including absence with medical certificate – is acceptable.</p>			<p>This optional course is not subject to grading and will only be marked as “passed” on the Master’s certificate.</p> <p>It will only be listed on your Master’s certificate if explicitly applied for (see § 8 (3) ÜPO).</p>			

Modul: Immunology and Microbiology [MSBME-117/2015]

MODUL TITEL: Immunology and Microbiology						
Fachsemester	1	Kreditpunkte	5	Sprache	English	
Titel			Curriculare Verankerung	Fachsemester	CP	SWS
Lecture "Immunology and Microbiology" [MSBME-117.a/2015]			Semesterfixierte Wahlpflichtleistung	1	0	2
Practical Course Immunology and Microbiology [MSBME-117.c/2015]			Semesterfixierte Wahlpflichtleistung	1	0	1
Exam Immunology and Microbiology [MSBME-117.d/2015]			Semesterfixierte Pflichtleistung	1	5	0
Voraussetzungen			Benotung/Dauer			
<p>Knowledge in general cell biology.</p> <p>Attendance at the lectures is voluntary, but attendance at the practical courses is compulsory.</p> <p>Only 10% absence – including absence with medical certificate – is acceptable for the compulsory parts. The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>Oral Exam. Duration 30 min</p> <p>The mark of the exam is the mark of the module.</p>			

Modul: Bioinformatics [MSBME-118/2015]

MODUL TITEL: Bioinformatics						
Fachsemester	1	Kreditpunkte	5	Sprache	English	
Titel			Curriculare Verankerung	Fachsemester	CP	SWS
Lecture "Bioinformatics" [MSBME-118.a/2015]			Semesterfixierte Wahlpflichtleistung	1	0	2
Exercise "Bioinformatics" [MSBME-118.b/2015]			Semesterfixierte Wahlpflichtleistung	1	0	1
Exam Bioinformatics [MSBME-118.d/2015]			Semesterfixierte Wahlpflichtleistung	1	5	0
Voraussetzungen			Benotung/Dauer			
<p>Attendance at the lectures is voluntary, but attendance at the exercises is compulsory. Only 10% absence – including absence with medical certificate – is acceptable for the compulsory parts. The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>Written exam. Duration 60-120 min. A minimum score of usually 50% is required to pass. The mark of the module is the mark of the exam.</p>			

Modul: Continuum Mechanics [MSBME-150 15/2015]

MODUL TITEL: Continuum Mechanics						
Fachsemester	2	Kreditpunkte	5	Sprache	English	
Titel			Curriculare Verankerung	Fachsemester	CP	SWS
Lecture: Continuum Mechanics [MSBME-150 15.a/2015]			Freiwillige Leistung	2	0	2
Exercise: Continuum Mechanics [MSBME-150 15.b/2015]			Freiwillige Leistung	2	0	1
Exam: Continuum Mechanics [MSBME-150 15.d/2015]			Freiwillige Leistung	2	5	0
Voraussetzungen			Benotung/Dauer			
<p>Recommended: Module Tensor Algebra and Tensor Analysis for Engineers I.</p> <p>Attendance at the lectures is voluntary, but attendance at the exercises is compulsory. Only 10% absence – including absence with medical certificate – is acceptable for the compulsory parts. The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>Written exam. Duration 90-120min. A minimum score of usually 50% is required to pass. The mark of the module is the mark of the exam.</p> <p>This optional course is subject to grading, but the results do not influence the overall grading on your Master's certificate. It will only be listed on your Master's certificate if explicitly applied for (see § 8 (3) ÜPO).</p>			

Modul: Tensor Algebra and Tensor Analysis for Engineers I [MSBME-151 15/2015]

MODUL TITEL: Tensor Algebra and Tensor Analysis for Engineers I					
Fachsemester	1	Kreditpunkte	5	Sprache	English
Titel	Curriculare Verankerung		Fachsemester	CP	SWS
Lecture: Tensor Analysis and Tensor Algebra for Engineer I [MSBME-151 15.a/2015]	Freiwillige Leistung		1	0	2
Exercise: Tensor Analysis and Tensor Algebra for Engineer I [MSBME-151 15.b/2015]	Freiwillige Leistung		1	0	2
Exam: Tensor Analysis and Tensor Algebra for Engineer I [MSBME-151 15.d/2015]	Freiwillige Leistung		1	5	0
Voraussetzungen			Benotung/Dauer		
<p>Recommended: Basic knowledge of mathematics and in particular matrix algebra</p> <p>Attendance at the lectures is voluntary, but attendance at the practical courses is compulsory. Only 10% absence – including absence with medical certificate – is acceptable for the compulsory parts. The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>Written Exam, Duration 90-120min. A minimum score of usually 50% is required to pass. The mark of the module is the mark of the exam.</p> <p>This optional course is subject to grading, but the results do not influence the overall grading on your Master's certificate. It will only be listed on your Master's certificate if explicitly applied for (see § 8 (3) ÜPO).</p>		

Modul: Mechanics/Biomechanics/Fluid Mechanics [MSBME-2030/2015]

MODUL TITEL: Mechanics/Biomechanics/Fluid Mechanics					
Fachsemester	1	Kreditpunkte	5	Sprache	English
Titel	Curriculare Verankerung		Fachsemester	CP	SWS
Lecture: Mechanics/Biomechanics/Fluid Mechanics [MSBME-2030.a/2015]	Semesterfixierte Pflichtleistung		1	0	2
Exercise: Mechanics/Biomechanics/ Fluid Mechanics [MSBME-2030.b/2015]	Semesterfixierte Pflichtleistung		1	0	2
Exam: Mechanics/Biomechanics/Fluid Mechanics [MSBME-2030.d/2015]	Semesterfixierte Pflichtleistung		1	5	0
Voraussetzungen			Benotung/Dauer		
<p>Engineering Mechanics and Mathematics.</p> <p>Attendance at the lectures is voluntary, but attendance at the exercises is compulsory. Only 10% absence – including absence with medical certificate – is acceptable for the compulsory parts. The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>The module consists of two exams: a) Mechanics/Biomechanics: written exam, duration 90min, or oral exam duration 30 min; minimum usually 50% to pass. b) Fluid mechanics: oral exam, duration 30min. The mark of the module is the average of the respective marks awarded in each exam. Each exam has to be passed separately and will be equally considered. In case of a partial exam failure, only the failed exam will have to be re-attempted.</p>		

Modul: Cell Culture and Tissue Engineering [MSBME-305/2015]

MODUL TITEL: Cell Culture and Tissue Engineering					
Fachsemester	3	Kreditpunkte	5	Sprache	English
Titel	Curriculare Verankerung		Fachsemester	CP	SWS
Lecture "Cell Culture and Tissue Engineering" [MSBME-305.a/2015]	Semesterfixierte Pflichtleistung		3	0	2
Practical Course "Cell Culture and Tissue Engineering" [MSBME-305.c/2015]	Semesterfixierte Pflichtleistung		3	0	2
Exam "Cell Culture and Tissue Engineering" [MSBME-305.d/2015]	Semesterfixierte Pflichtleistung		3	5	0
Voraussetzungen			Benotung/Dauer		
<p>Successfully passed the modules Medical Biology and Chemistry/Biochemistry from 1st semester.</p> <p>These subjects should be known:</p> <p>CHEMISTRY Types of chemical bonds that hold atoms together in molecules. Polar and nonpolar molecules and the important role that polarity plays in interactions of biological molecules. Concepts of acids, bases, pH, and buffering. Types of biomaterials that are available and their common uses.</p> <p>BIOMOLECULAR PRINCIPLES Basic concepts of biochemical energetics, including the role of adenosine-5'-triphosphate (ATP) in the transformation of energy into biochemical work. Major classes of biological polymers: proteins, polysaccharides, and nucleic acids. Structure of polysaccharides as polymers of monosaccharides, including the simple sugars glucose, galactose, and fructose. Basic structure of nucleic acids as polymers of nucleotides and how that structure is different in deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) polymers. Basic structure of proteins, which are polymers of amino acids, and how the diversity of amino acid structure influences protein three-dimensional structure and function. Basic features of biological membranes, which are lipid bilayers that are decorated with proteins and carbohydrates.</p> <p>CELLULAR PRINCIPLES Basic components of eukaryotic cells and the differences between eukaryotic and prokaryotic cells. Basic role of the cytoskeleton, ribosomes, endoplasmic reticulum (ER), Golgi apparatus, mitochondria, lysosomes, and genomic deoxyribonucleic acid (DNA) in cell function. Structure of extracellular matrix (ECM) and its role in tissue function. Role of membrane proteins in regulating transport through cell membranes and regulating cell adhesion. Cell cycle and cell division by mitosis and meiosis. Basic principles of stem cells and differentiation. Basic elements of cell culture and its importance in modern biomedical science and engineering.</p> <p>Attendance at the lectures is voluntary, but attendance during the student presentations of research papers and the practical courses is compulsory.</p> <p>Only 10% absence – including absence with medical certificate – is acceptable for the compulsory parts.</p> <p>The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>Written exam. Duration 90-120 minutes, A minimum score of usually 50% is required to pass. The mark of the module is the mark of the exam.</p>		

Modul: Systems Biology [MSBME-306/2015]

MODUL TITEL: Systems Biology					
Fachsemester	3	Kreditpunkte	5	Sprache	English
Titel	Curriculare Verankerung		Fachsemester	CP	SWS
Lecture "Systems Biology" [MSBME-306.a/2015]	Semesterfixierte	Pflichtleistung	3	0	2
Practical Course "Systems Biology" [MSBME-306.c/2015]	Semesterfixierte	Pflichtleistung	3	0	2
Exam "Systems Biology" [MSBME-306.d/2015]	Semesterfixierte	Pflichtleistung	3	5	0
Voraussetzungen			Benotung/Dauer		
<p>Successfully passed the modules Medical Biology and Chemistry/Biochemistry from the 1st semester and basic knowledge in Mathematics.</p> <p>Attendance at the lectures is voluntary, but attendance at the practical courses is compulsory. Only 10% absence – including absence with medical certificate – is acceptable for the compulsory parts. The exam can only be attended if the compulsory parts have been fulfilled.</p>			<p>Written exam. Duration 90-120 minutes, A minimum score of usually 50% is required to pass. The mark of the module is the mark of the exam.</p>		

Anlage 3: Geänderter Studienverlaufsplan

**Biomedical Engineering
RWTH Aachen University**

Curriculum

from WS 2017/2018

Semester	1				2				3				CP	Exam
	L	S	E	P	L	S	E	P	L	S	E	P		
Courses														
Chemistry/Biochemistry	2	-	-	1									5.0	GR
Medical Biology	2	-	-	1									5.0	GR
Anatomy/Physiology	2	-	1	1									5.0	GR
Control and Electrical Engineering	2	-	2	-									5.0	GR
Mechanics/Biomechanics/Fluid Mechanics	2	-	2	-									5.0	GR
Elective Mandatory Course	x	x	x	x									5.0	GR
Medical Imaging (Imaging Techniques)					2	-	-	2					5.0	GR
Material Science and Processing					3	-	1	-					5.0	GR
Ethics/Intellectual Property and Reg. Affairs					-	2	-	1					5.0	GR
Internship (min. 8 weeks)								x					10.0	GR
Elective Mandatory Course					x	x	x	x					5.0	GR
Image Guided Therapy/Molecular Imaging									2	-	0.5	0.5	5.0	GR
Image Processing and Handling									2	-	1	-	5.0	GR
Art. Organs I: Heart, Lung									2	-	-	1	5.0	GR
Art. Organs II: Kidney and Liver support									2	-	-	1	5.0	GR
Cell Culture and Tissue Engineering									2	-	-	2	5.0	GR
Systems Biology									2	-	-	2	5.0	GR
Elective Mandatory Course														
Biomedical Sensors and Microsystems*	2	-	1	-					2	-	1	-	5.0	GR
Mechanics of living tissue*	2	-	2	-					2	-	2	-	5.0	GR
Medical Statistics*	2	-	2	-					2	-	2	-	5.0	GR
Immunology and Microbiology*	2	-	-	1					2	-	-	1	5.0	GR
Bioinformatics*	2	-	1	-					2	-	1	-	5.0	GR
Experimental Medicine (Biom. Diagnostics)					-	2	1	-					5.0	GR
Biomechanics and Mechanobiology for soft biological tissues					1	-	2	-					5.0	GR
Methodical Design/ Project Management					-	1	-	2					5.0	GR
Optophysiology					2	1	--	-					5.0	GR
Advanced Biomaterials (Hard Tissue Implants and Prostheses & 3D Bioprinting)					-	2	-	1					5.0	GR
Optional Courses														
Selected Topics of Inelasticity Theory									2	-	2	-	5.0	GR
Tensor Algebra and Tensor Analysis for Eng. Students I	2	-	2	-					2	-	2	-	5.0	GR
Neurosciences	-	1	-	-	-	1	-	-	-	1	-	-	2.0	P/NP
Practical Course in Immunohistochem. Neuroscience	-	1	-	1	-	1	-	1	-	1	-	1	3.0	P/NP
Practical Course in Biochem. Neuroscience	-	1	-	1	-	1	-	1	-	1	-	1	3.0	P/NP
MATLAB					1	-	2	-					5.0	GR
Selected Topics in Regard to Art. Organs					-	1	-	-					2.0	P/NP
Continuum Mechanics					2	-	1	-					5.0	GR
Porous Media Mechanics					2	-	2	-					5.0	GR
Intensive Care / Monitoring					-	0.5	-	0.5					2.0	P/NP
Seminar and Journal Club on Mol. Imaging					-	2	-	-					3.0	P/NP
Master Thesis (4th Semester)														
Master Thesis													25.0	GR
Master Thesis Colloquium													5.0	GR

*Elective Mandatory courses as well as Optional courses may be taken in the 1st or 3rd semester, except for courses with prerequisites.

Key: L: Lecture, S: Seminar, E: Exercise P: Practical Course, P/NP: passed /not passed GR: graded