

## **-Reading Version-**

# **Statute Of the Department of Applied Natural Sciences of the “Technischen Hochschule Lübeck” and the “Universität zu Lübeck” Regarding the Coursework and Examinations of the International Master’s Degree Program in Biomedical Engineering – Study and Examination Regulations 2021 Master’s Degree Program Biomedical Engineering – From April 6<sup>th</sup>, 2021**

*The following statutes are issued based on Section 52 of the Higher Education Act (Hochschulgesetzes) in the version published on February 5, 2016 (GVOBl. Schl.-HS 39), last amended by the Act from December 13<sup>th</sup>, 2020 (GVOBl. Schl.-HS 2). This takes place after a resolution by the Convention of the Faculty of Applied Sciences on March 17<sup>th</sup>, 2021, following the Senate's opinion on March 31<sup>st</sup>, 2021 and with the approval of the Presidium of the “Technischen Hochschule Lübeck” on April 1<sup>st</sup>, 2021:*

## **Part I – General Section**

### **§1**

#### **Scope**

These study and examination regulations regulate the goals and structure of the coursework as well as the requirements and implementation of examinations in the joint international Master’s Degree Program in Biomedical Engineering at the “Technischen Hochschule Lübeck” and the “Universität zu Lübeck”. It supplements the Examination Procedure Regulations (PVO) of the Lübeck University of Applied Sciences with course-specific provisions.

### **§ 2**

#### **Degree Program**

The master's examination of the degree program for Biomedical Engineering constitutes a further professional qualification, dependent on the successful completion of a first professional degree. The examination is intended to demonstrate a high level of technical and scientific knowledge, and to determine whether the students have a good grasp of the interrelationships in their technical field, are able to apply scientific methods and findings in medical technology, and whether they have the ability to apply the fundamental, subject-specific and interdisciplinary knowledge competently and purposefully in both theory and practice.

**§3**  
**Degree Designation**

Upon successful completion of the master's degree program, the "Technischen Hochschule Lübeck" and the "Universität zu Lübeck" award the academic degree "Master of Science" (M.Sc.) as a second professional qualification.

**Part II – Objectives and Structure of the Coursework**

**§ 4**  
**Qualification goals, content and professional fields of activity**

- (1) The graduates know the basic professional methods and approaches of medical engineering and are able to apply them with confidence. They are familiar with the core competencies of medical technology, such as essential devices for diagnostics and therapy, the specifics of the development of these devices, the interaction of these devices with people, as well as the basic regulatory aspects of medical devices.
- (2) The graduates can analyze and apply goal-oriented problem solving to solve basic problems in medical engineering as well as structure subject-related content and present these in appropriate written and oral form. They possess the ability to think and act scientifically, to make critical judgments, to act responsibly as well as to communicate and cooperate with others. They possess a high level of intercultural competence.
- (3) The graduates acquire basic knowledge and skills in the field of medical engineering. Important subject-related content is the analysis of problems and the implementation of problem-solving strategies, which are of great importance for professional activity in a society that is increasingly characterized by high-tech medicine. Within the scope of projects, the self-organization of teams is learned. Presentation skills are practiced and reinforced in seminars as well as through the student conference.
- (4) The occupational profile of medical engineers is broad in terms of industry, company size and the specific field of work. However, the majority of graduates work in the field of medical device development, for which working independently, abstract thinking and creativity as well as the ability to work in a team and good communication skills are important prerequisites. The Master's degree in Biomedical Engineering develops these skills within the scope of projects and prepares graduates for the aforementioned tasks. Moreover, the graduates are qualified to take up a further doctoral project.

**§ 5**  
**Admission Requirements**

- (1) Admission requirements for the Master's Program are as follows
  1. **Degree:**
    - 1) A first professional degree made up of at least 180 ECTS credit points (CP) in the field of electrical engineering, computer science, mechanical engineering, mechatronics, medical engineering, physical engineering, process engineering or materials engineering with a minimum Grade Point Average (GPA) of 2.5 (German Grading System).
  - OR
  - 2) A first professional degree from a university, an institute of higher education, a university of applied sciences or an equivalent institute of higher education within the scope of the University Framework Act (Hochschulrahmengesetzes) in the field of electrical engineering, computer science, mechanical engineering, mechatronics, medical engineering, physical engineering, process engineering, materials engineering or in a comparable course of study with a minimum GPA of 2.5 (German Grading System).

- 3) A decision regarding admission for graduates of degree programs other than the aforementioned engineering courses will be made upon application.

## 2. **Language**

A good command of the English language is required in order to be able to follow lectures/courses held in the English-language. The following serves as proof of English language skills:

- 1) Proof of good English language skills at a B2 level according to the common European framework of reference via one of the following:
    - a. TOEFL Test
    - b. Or a comparable internationally recognized English language test that provides evidence of the corresponding language level
    - c. A university diploma/certificate attesting to the relevant knowledge
- OR
- 2) Proof of fulfillment of at least one of the following criteria:
    - a. English was the official language of schooling
    - b. At least 6 months of work or study in an English-speaking country
    - c. English was the official language of the degree program qualifying one for the Biomedical Engineering Master's Program.

In cases of doubt, the examination board shall make the decision regarding proof of linguistic aptitude.

- (2) The decision regarding admission is made by the degree program coordinator in an internal university selection process that is decided by the joint course committee, on the basis of Grade Point Average, evidence of English language skills, the duration and content of the first professional degree as well as the applicants' citizenship.
- (3) Admission is to be denied if the applicant has definitively failed the master's examination for the Biomedical Engineering degree program or a related course at an institute for higher education within the scope of the University Framework Act (Hochschulrahmengesetzes) or if he or she is currently in an examination procedure for this course at another university.

## **§ 6**

### **Study Program Objective, Start, Standard Duration, Scope, Structure and Content**

- (1) Application-oriented teaching should provide a scientifically-based education, which enables one to work independently within their profession. Through the degree program, students should acquire the ability to think and act scientifically. They should know the corresponding methods and have specialist knowledge of medical technology during the entire life-cycle of a medical product, and be able to independently apply and further develop these.
- (2) The degree program begins in the Winter Semester.
- (3) The standard program duration is four semesters
- (4) The scope of the program comprises 120 ECTS credit points (CP)
- (5) Students specializing in the medical track (without a biomedical background) usually complete 54 weekly hours per semester (SWS) with their studies.
- (6) Students specializing in the technical track (with a biomedical background) usually complete 52 weekly hours per semester (SWS) with their studies.

- (7) The degree program is divided into the following:

	<b>Semester</b>	<b>ECTS Credit</b>
Compulsory Modules for all students	1-2	20
Compulsory Module – Those specializing in the Medical Track	1-2	22
Compulsory Module – Those specializing in the Technical Track	1-2	14
Compulsory Elective Module Catalogue 1 for those specializing in the Technical Track	1	8
Compulsory Elective Module Catalogue 2 for all students	2	2
Compulsory Elective Module Catalogue 3 for all students	2	10
Elective Module	2	6
Research Internship	3	24
Student Conference	3	6
Thesis	4	26
Final Colloquium	4	4
<b>Total:</b>		<b>120</b>

- (8) The degree program comprises the modules listed in Appendix 1, in which the students must provide evidence of examination and study achievements in order to successfully complete the course of study.
- (9) The compulsory elective module from Catalogue 1 for those specializing in the Technical Track must be chosen to fulfill a scope of 16 CP. The selection catalogue can be found in Appendix 1.
- (10) The compulsory elective module from Catalogue 2 must be chosen to fulfill a scope of 2 CP. The selection catalogue can be found in Appendix 1.
- (11) The compulsory elective module from Catalogue 3 must be chosen to fulfill a scope of 10 CP. The selection catalogue can be found in Appendix 1.
- (12) The elective module can be chosen freely from the courses offered by the Lübeck University of Applied Sciences, the University of Lübeck or another university to fulfill a scope of 6 CP. No module may be assigned twice. A module from another course of study that is identical in content to a module of this course of study may not be selected. The selected modules must be modules from a master's degree program.

**§ 7**  
**Coursework**

- (1) Achievement of the respective learning objectives is supported by different forms of teaching and learning. In particular, at the “Technischen Hochschule Lübeck” and the “Universität zu Lübeck, the following types of courses are offered:

Course Type	Course Content
Lectures (L)	Conveying of subject matter
Exercises (E)	Processing and reinforcement of the subject matter with the chance for discussion
Practical Training (Pr)	Practical (lab) work within the university in small groups
Projects (Pj)	Processing of project tasks
Seminars (S)	Processing of selected topics
Excursions (E)	Study trips to introduce students to the conditions of the professional world, in some cases with discussions and presentations by the participants

- (2) The subject matter and associated course type as well as course duration, scope, number and time can be found in Appendix 1 of these study and examination regulations.
- (3) The Dean's Office may authorize courses to be carried out either entirely or partially as online-courses.

**Part III – Requirements and Execution of Examinations**

**§8**  
**Thesis and Final Colloquium**

- (1) The master's thesis is usually written during the fourth semester. It amounts to 26 CP, with a processing time of 6 months.
- (2) The final colloquium is carried out as an oral examination and amounts to 4 CP. The duration is 60 minutes. The presentation of the thesis should not exceed 15 minutes of the 60 minute period.

**§9**  
**Prerequisites and Admission**

- (1) Admission to a course is granted to the following:
1. One who is enrolled in the Biomedical Engineering master's degree program
- AND
2. One who has completed the relevant prerequisite study achievements and preliminary examinations
- (2) Admission to an examination is granted to the following
1. One who is enrolled in the Biomedical Engineering master's degree program
- AND
2. One who has completed the relevant prerequisite study achievements and preliminary examinations
- (3) Admission to courses and examinations is decided by the examiner. In cases of doubt, the decision is made by the examination board. Notification of approval will be made in a suitable manner.
- (4) Admission will be denied if the admission requirements are not met.

- (5) The prerequisites for admission to the master's thesis are proof of completion of all study and examination achievements that are to be achieved by the end of the first semester according to the Module Plan of this study and examination regulations, at least 20 credit points from the second semester, and the successful completion of the research internship.
- (6) The prerequisites for admission to the oral final examination (colloquium) are proof of all achievements in accordance with the Module Plan of this study and examination regulations and the passed master's thesis.

#### **§10 Examination Procedure**

The examination procedure is based on the examination procedure regulations (PVO) of the "Technischen Hochschule Lübeck", unless otherwise stated in these study and examination regulations.

#### **§11 Language of Examination**

Exams are usually carried out in the English language. In justified exceptional cases, the chairperson of the examination board may, at the request of the student, determine that examinations can also be performed in the German language.

#### **§ 12 Research Internship**

- (1) Through the research internship students in the Biomedical Engineering master's program have the opportunity to gain practical experience in the application of research methods in future areas of work. It serves as proof of engineering work in the area of medical technology.
- (2) The duration of the research internship is at least 16 full-time workweeks. It can be completed in a maximum of two parts, each consisting of 8 full-time workweeks.
- (3) Students are required to register for the research internship in due time and form. Registration takes place via a form at the degree program coordinator. The content of the research internship must be approved by the examination board.
- (4) Details regarding subject and type of research internship are regulated by the guidelines decided upon by the degree program committee.

#### **§ 13 Evaluation, Weighting and Calculation of the Final Grade**

- (1) For modules consisting of several sub-module examinations, each individual sub-module exam must be graded with at least "sufficient" (4.0) in order for the module to be considered as "passed".
- (2) The final module and sub-module exams are weighted according to the number of CP to be awarded. The corresponding CP for the weighting of modules are specified in Appendix 1.
- (3) Contrary to §15 Paragraph 8 of the Examination Procedure Regulations of the "Technischen Hochschule Lübeck", the module grades, the thesis grade and colloquium grade are weighted by the corresponding CP to form the final grade. The corresponding CP for the weighting are specified in Appendix 1

#### **§ 14 Final Clause**

These statutes take effect on September 1<sup>st</sup>, 2021 and apply to all newly enrolled students starting with the winter semester 2021/2022.

**Appendix 1 to the Study and Examination Regulations 2021 Master's Degree Program Biomedical Engineering**

Module No.	Module Name	Course Name	Course Type	Semester	Achievement		Requirements	Language	SWS	ECTS (CP)
					Exam Achievement	Study Achievement				
<b>Compulsory Modules for all Students</b>										
<b>1.1</b>	<b>System Theory</b>							<b>English</b>	<b>4</b>	<b>6</b>
		Signal and Systems	Lecture	1	MP-M (20 Min.)				2	3
		Numerical Methods	Lecture	1	MP-K (90 Min.)				2	3
	<b>MatLab - Workshop</b>							<b>English</b>	<b>2</b>	<b>4</b>
		MatLab - Workshop	Project	1	MP-K (90 Min.)		**		2	4
<b>2.1</b>	<b>Imaging</b>							<b>English</b>	<b>6</b>	<b>8</b>
		Imaging	Lecture	2	MP-K (90 Min.)				2	3
		Image Processing	Lecture	2	MP-K (90 Min.)				2	3
		Numerical Methods - Lab	Practical Work	2		Tb	**		2	2
<b>2.2</b>	<b>Management</b>							<b>English</b>	<b>4</b>	<b>4</b>
		Scientific Writing	Project	2		Tb	**		2	2
		Compulsory elective module from Catalogue 2		2					2	2
<b>Compulsory Module – Specializing in the Medical Track (students without biomedical background)</b>										
<b>MT 1</b>	<b>Medicine</b>							<b>English</b>	<b>8</b>	<b>8</b>
		Anatomy and Physiology	Lecture	1	MP-K (90 Min.)				4	4
		Medical Microbiology and Hygiene	Project	1	MP-PF		**		4	4
<b>MT2</b>	<b>Natural Science</b>							<b>English</b>	<b>4</b>	<b>4</b>
		Biomechanics	Lecture	1	MP-K (90 Min.)				2	2
		Biophysics	Lecture	1	MP-K (90 Min.)				2	2
<b>MT3</b>	<b>Medical Technology</b>							<b>English</b>	<b>6</b>	<b>8</b>
		Medical Technology	Lecture	1	MP-K (90 Min.)				4	6
		Medical Technology-Lab.	Practical Work	1		Tb	**		2	2

<b>MT4</b>	<b>Regulatory Affairs</b>							<b>English</b>	<b>2</b>	<b>2</b>
		Regulatory Affairs – online	Lecture	2	MP-K (90 Min.)				2	2
<b>Compulsory Module – Specializing in the Technical Track (students with biomedical background)</b>										
<b>TT1</b>	<b>Signal Processing</b>							<b>English</b>	<b>4</b>	<b>4</b>
		Signal Processing	Lecture	1	MP-M (20 Min.)				2	2
		Signal Processing - Lab.	Practical Work	1		Tb	**		2	2
<b>TT2</b>	<b>Medical Electronics</b>							<b>English</b>	<b>2</b>	<b>2</b>
		Medical Electronics - Projects	Project	2		Tb	**		2	2
<b>TT3</b>	<b>Electronics and Optics</b>							<b>English</b>	<b>6</b>	<b>8</b>
		Medical Electronics	Lecture	1	MP-K (90 Min.)				4	5
		Photonics	Lecture	1	MP-K (90 Min.)				2	3
<b>Compulsory Elective Module – Catalogue 1 specializing in the Technical Track</b>										
<b>TT4</b>	<b>Design Engineering</b>							<b>English</b>	<b>8</b>	<b>8</b>
		Design Methodology	Lecture	1	MP-K (90 Min.)				2	2
		Design Methodology - Lab	Practical Work	1		Tb	**		2	2
		Material Science	Lecture	1	MP-K (90 Min.)				4	4
<b>TT5</b>	<b>Control Systems</b>							<b>English</b>	<b>5</b>	<b>8</b>
		Machine Learning	Lecture	1	MP-M (20 Min.)		**		2	3
		Machine Learning	Exercise							1
		Model Predictive Control	Lecture	1	MP-M (20 Min.)				2	4
<b>Compulsory Elective Module – Catalogue 2 for all students</b>										
<b>2.3</b>	<b>Health Technology Assessment</b>							<b>English</b>	<b>2</b>	<b>2</b>
		Health Technology assessment	Lecture	2	MP-K (90 Min)				2	2
<b>2.4</b>	<b>Innovation Management and Marketing</b>							<b>English</b>	<b>2</b>	<b>2</b>
		Innovation Management	Lecture	2	MP-K (90 Min)				2	2



		and Marketing								
2.5	<b>Quality Management in Health Care</b>							<b>English</b>	<b>2</b>	<b>2</b>
		Quality Management in Health Care	Project	2	MP-PF		**		2	2
2.6	<b>Successful Negotiation and Communication</b>							<b>English</b>	<b>2</b>	<b>2</b>
		Successful Negotiation and Communication	Project	2	MP-M (20 Min.)		**		2	2
<b>Compulsory Elective Module – Catalogue 3 for all students</b>										
2.7	<b>Biophysics</b>							<b>English</b>	<b>2</b>	<b>2</b>
		Biophysics	Project	2	MP-PA		**		2	2
2.8	<b>Clinical Applications</b>							<b>English</b>	<b>2</b>	<b>2</b>
		Clinical Applications	Project	2	MP-K (60 Min)		**		2	2
2.9	<b>Human Biochemistry</b>							<b>English</b>	<b>4</b>	<b>4</b>
		Human Biochemistry	Project	2	MP-PF		**		4	4
2.10	<b>Medical Technology – Selected Topics</b>							<b>English</b>	<b>4</b>	<b>4</b>
		Medical Technology – Selected Topics	Project	2	MP-PA		**		4	4
2.11	<b>Photonics II</b>							<b>English</b>	<b>4</b>	<b>4</b>
		Photonics II	Project	2	MP-PF		**		4	4
2.12	<b>Specialized Biomechanics</b>							<b>English</b>	<b>2</b>	<b>2</b>
		Specialized Biomechanics	Project	2	MP-K (90 Min)		**		2	2
2.13	<b>Artificial Intelligence</b>							<b>English</b>	<b>3</b>	<b>4</b>
		Artificial Intelligence	Lecture	2	MP-K (90 Min)				2	3
		Artificial Intelligence	Exercise	2					1	1
2.14	<b>Computer Aided Techniques in Design</b>							<b>English</b>	<b>4</b>	<b>5</b>
		Computer Aided Techniques in Design	Lecture	2	MP-K (90 Min)		**		3	3
		Computer Aided Techniques in Design	Practical Work	2		Tu			1	2

<b>2.15</b>	<b>Computer Vision</b>							<b>English</b>	<b>3</b>	<b>4</b>
		Computer Vision	Lecture	2	MP-M (20 Min.)		**		2	4
		Computer Vision	Exercise	2					1	
<b>2.16</b>	<b>Implantable Hearing De- vices</b>							<b>English</b>	<b>2</b>	<b>3</b>
		Implantable Hearing De- vices	Lecture	2	MP-K (60 Min)				2	3
<b>2.17</b>	<b>Medical Deep Learning</b>							<b>English</b>	<b>4</b>	<b>6</b>
		Medical Deep Learning	Lecture	2	MP-K (90 Min)		**		3	6
		Medical Deep Learning	Exercise	2					1	
<b>2.18</b>	<b>Medical Robotics</b>							<b>English</b>	<b>3</b>	<b>4</b>
		Medical Robotics	Lecture	2	MP-K (90 Min)		**		2	4
		Medical Robotics	Exercise	2					1	
<b>2.19</b>	<b>Nuclear Imaging</b>							<b>English</b>	<b>2</b>	<b>3</b>
		Nuclear Imaging	Lecture	2	MP-K (90 Min)				2	3
<b>Degree Completion</b>										
<b>3.1</b>	<b>Research Internship</b>							<b>English</b>		<b>30</b>
		Research Internship	Practical Work	3		Tu				24
		Student Conference	Seminar	3		Tu	**			6
<b>4.1</b>	<b>Final</b>							<b>English</b>		<b>30</b>
		Final Thesis		4	6 Months					26
		Final Colloquium		4	MP-M (60 Min.)					4

**CP: Credit Points**

**MP-K: Module Test, written examination**

**MP-M: Module Test, oral**

**MP-PF: Module Test, portfolio review**

**MP-PA: Module Test, project work**

**Tb: Graded Test (Study achievement)**

**Tu: Ungraded Test (Study achievement)**

\*\* Attendance is compulsory for the course

