

These degree programme and examination regulations have been worded carefully to be up to date; however, errors cannot be completely excluded. The official German text available at the Examinations Office is the version that is legally binding.

Note: For students who started their studies before the latest amendment came into effect: please also note the previous amendments with their transitory provisions.

Degree Programme and Examination Regulations for the Master's Degree Programme Medical Engineering at the University of Erlangen-Nürnberg

– FOMT –

Dated 15 September 2009

amended by statutes of
30 October 2009
04 March 2010
09 March 2011
05 August 2011
24 February 2012
31 July 2012
18 February 2013
18 February 2014

Based on Section 13 (1)(2), Section 43 (5)(2), Section 61 (2)(1) of the Bavarian Higher Education Act (Bayerisches Hochschulgesetz, BayHSchG) in conjunction with Section 57 QualV (Qualification Regulations for Studies at Public Universities in Bavaria), the University of Erlangen-Nürnberg enacts the following examination regulations:

Part I: General Conditions

Section 35 Scope

¹The degree programme and examination regulations govern examinations for the Bachelor's and consecutive Master's degree programme Medical Engineering. ²It complements the General Examination Regulations for the Bachelor's and Master's Degree Programmes of the Faculty of Engineering at the University of Erlangen-Nürnberg as amended from time to time.

Section 36 Bachelor's Degree Programme, Standard Duration of Studies, Start of the Degree Programme, Language

(1) ¹The degree programme shall consist of the compulsory modules of the module groups B1–B4, core modules of the module group B5 or B6, and specialisation modules of the module group B8, as well as core skills of the module group B7 and the Bachelor's thesis module (B9). ²It includes ten weeks' vocational practice (up to four of which shall be spent in a healthcare institution) to be carried out in the course of the degree programme according to placement guidelines. ³Students shall choose a

branch of study made up from core and specialisation modules of the module groups B5 or B6 and B8 which complement each other with regard to content. ⁴The modules and recommended programme structure can be found in **Appendix 1**. ⁵The fifth or sixth semester is recommended for stays abroad.

(2) ¹The degree programme Medical Engineering may be studied with one of the following two branches of study:

1. Imaging techniques (Electrical Engineering/Information Technology/Computer Science)
2. Device Engineering and Prosthetics (Mechanical Engineering/Materials Science/Chemical and Biological Engineering)

²The branch of study shall be chosen by registering for the first examination in a module from the module group B5, B6, or B8. ³After choosing the branch of study, the core modules of the module group B5 must be completed for the branch of study Imaging Techniques; the core modules of the module group B6 must be completed for the branch of study Device Engineering and Prosthetics. ⁴A change of the branch of study shall only be permitted in justified, exceptional cases upon written request and with the Examination Committee's approval. ⁵The module catalogue for the branches of study (core modules worth 40 ECTS credits and corresponding specialisation modules worth 20 ECTS credits) may be adjusted by the Examinations Committee; publication shall occur in the form of a bulletin.

(3) The standard duration of studies shall be six semesters.

(4) The Bachelor's degree programme Medical Engineering shall begin in the winter semester.

(5) ¹The teaching language of the Bachelor's degree programme shall be German or English and shall be announced in the module handbook according to local practice before the beginning of the lecture period. ²The language of written examinations shall correspond to the teaching language. ³The provision in Sentence 2 may be waived for oral examinations in consultation with the examinee.

Section 37 Master's Degree Programme, Standard Duration of Studies, Start of the Degree Programme, Language

(1) ¹The Master's degree programme Medical Engineering shall consist of a medical specialisation subject from the module group M1, core modules from the module groups M2 to M4, specialisation modules from the module groups M5 and M6, and elective modules from the module group M7, and the module Master's Thesis (M8).

²The module group M6 includes laboratory training and a research laboratory.

³Students shall choose a branch of study made up of modules from the module groups M2, M3 and M5.

(2) The Master's degree programme Medical Engineering shall have a standard duration of four semesters.

(3) The Master's degree programme Medical Engineering may be started in the winter semester or in the summer semester.

(4) ¹The teaching language of the Master's degree programme shall be German or English and shall be announced in the module handbook according to local practice before the beginning of the lecture period. ²The language of written examinations shall correspond to the teaching language. ³The provision in Sentence 2 may be waived for oral examinations in consultation with the examinee.

Part II: Special Provisions

1. Bachelor's Examination

Section 38 Scope of the Preliminary Examination (Grundlagen- und Orientierungsprüfung)

The preliminary examination (Grundlagen- und Orientierungsprüfung, GOP) according to Section 3 (1) ABMPO/TechFak shall have been passed if at least one module from each of the module groups B2 to B4 has been passed in the first year of study (first and second semesters) and modules worth a total of 30 ECTS credits have been passed.

(2) The ECTS credits allocated to each module are listed in column 4 and the type and scope of the examinations is given in column 5 in **Appendix 1**.

Section 39 Scope and Structure of the Bachelor's Examination, Admission Requirements

(1) ¹The Bachelor's examination shall comprise the modules of the module groups B1 to B9 listed in **Appendix 1**, whereby the module group B5 must only be completed by students of the branch of study Imaging Techniques and the module group B6 must only be completed by students of the branch of study Device Engineering and Prosthetics. ²The ECTS credits allocated to each module are listed in column 4 and the type and scope of the examinations is given in column 5 in **Appendix 1**.

(2) The Bachelor's examination shall have been passed if all modules specified in Section 39 (1) have been passed.

Section 40 Bachelor's Thesis

(1) ¹The Bachelor's thesis is supposed to enable students to learn to solve medical engineering problems independently. ²Requirements for the thesis shall be such that it can be completed with a workload of approximately 300 hours. ³10 ECTS credits shall be awarded for the thesis.

(2) The subject of the Bachelor's thesis shall be allocated by a full-time university lecturer (responsible lecturer) teaching in the compulsory, core, or specialisation modules of the Bachelor's or Master's degree programme Medical Engineering (with the exception of module B7.1); supervision shall be carried out by the responsible lecturer and/or research fellows from the same department, as well as at least one member of Universitätsklinikum or a comparable institution.

(3) ¹The Bachelor's thesis shall be written in German or English. ²It shall deal with a scientific subject from the field of medical engineering. ³The results of the Bachelor's thesis shall be presented in a presentation followed by a discussion. ⁴The date of the presentation shall be determined by the responsible lecturer either after the student has submitted their Bachelor's thesis or during the final stage of thesis work. ⁵The date shall usually be within four weeks after the date on which the thesis was submitted; students shall be notified of the date at least two weeks in advance.

Section 41 Grading of Course and Examination Achievements

¹An overall grade shall be calculated for each of the module groups B5 or B6, and B8; the individual module examinations shall be weighted with a factor corresponding to their ECTS credits. ²The overall grade of the module group B5 or B6 shall be weighted with 40 ECTS credits and the subject grade of the specialisation modules shall be weighted with 20 ECTS credits in the calculation of the overall grade.

2. Master's Degree Programme

Section 42 Qualification for a Master's Degree Programme, Certificates and Admission Requirements

(1) ¹A subject-specific degree within the meaning of Section 29 (1)(1) AB-MPO/TechFak shall be a Bachelor's degree in medical engineering that is equivalent according to these examination regulations. ²Applicants with a subject-related degree or a non-equivalent degree shall only be admitted to the Master's degree programme after passing an oral admission examination according to Paragraph 3.

(2) ¹Additionally, applicants whose native language is not German or English must provide proof of German or English language proficiency according to **Appendix 1 (2)(4) ABMPO/TechFak**. ²Proof of the level DSH-2 in the Deutsche Sprachprüfung für den Hochschulzugang (DSH) examination shall serve as proof of German language proficiency. ³It shall be considered to have been provided if it had to be provided for the degree described in Section 29 (1) ABMPO/TechFak and the degree was completed no less than one year previously. ⁴The following shall serve as proof of English language proficiency:

- an Internet-based TOEFL score of at least 100
- IELTS score of at least 6.5
- Cambridge Certificate in Advanced English
- UNIcert III
- CEFR C1

(3) Applicants shall be deemed as qualified for the Master's degree programme Medical Engineering at the Faculty of Engineering of the University of Erlangen-Nürnberg according to **Appendix 1**, Paragraph 5 (2)(2) ABMPO/TechFak if they have passed at least four of the B5 or B6 modules of the Bachelor's degree programme with an average module grade of 3.0 or better according to these examination regulations.

(4) In the oral admission examination according to **Appendix 1 (5)(3) et seq. AB-MPO/**

TechFak, applicants shall be evaluated according to the following criteria, weighted as specified:

- a good knowledge of the foundations of the subject (25%)
- good knowledge of a field of specialisation in medical image and data processing, medical electronics or medical device engineering, production technology and prosthetics corresponding to an eligible specialisation in the Master's degree programme (25%)
- description of a relevant subject-related project, knowledge of the relevant literature (25%)
- a positive prognosis based on improving progress during their course of studies (25 percent).

Section 43 Scope and Structure of the Master's Degree Programme

(1) ¹Master's students shall choose a branch of study in order to establish a subject-specific profile. ²The following branches of study are possible:

- Medical Image and Data Processing
- Medical Electronics
- Medical Production Technology, Device Engineering and Prosthetics

(2) The Master's degree programme shall contain the module groups listed in **Appendix 2**.

(3) ¹The module group M6 'Medical Engineering practical skills' comprises laboratory training and a research laboratory. ²For the laboratory training, students must select laboratory courses worth 5 ECTS credits from those offered by the following departments:

- Mechanical Engineering
- Materials Science
- Electrical, Electronic and Communication Engineering
- Computer Science

³5 ECTS credits for the research laboratory must be completed at a chair of the Faculty of Engineering. ⁴Instead of a research laboratory, the Degree Programme Committee's chairperson may also approve other ungraded elective modules from the course catalogue of the Faculty of Engineering worth 5 ECTS credits.

(4) Furthermore, 10 ECTS credits shall be obtained in engineering and non-engineering modules (M7) from the course catalogue of the entire University.

Section 44 Master's Degree Examinations

(1) Students shall choose their branch of study according to Section 43 (1) by registering for the examinations.

(2) Type and scope of the course and examination achievements are set out in **Appendix 2**. ²For individual modules that may be chosen from other degree programmes as part of the flexible budget in the module M7, the type, length and scope of the examinations can be found in the applicable examination regulations.

Section 45 Master's Thesis, Requirements for Subject Allocation

(1) The Master's Thesis module shall be worth 30 ECTS credits.

(2) ¹The Master's thesis is supposed to demonstrate students' ability to solve medical engineering problems independently. ²Requirements for the thesis shall be such that it can be completed with a workload of 900 hours within six months. ³Section 40 (2) and (3) shall apply accordingly.

(3) The requirements for admission to the Master's thesis shall be as follows:

1. achievement of 75 ECTS credits in the Master's degree programme
2. submission of relevant certificates if admission to the Master's degree programme was granted with conditions according to Section 29 (2)(2) AB-MPO/TechFak.

(4) In justified, exceptional cases, the Examinations Committee shall be entitled to grant admission to the Master's thesis early.

Part III: Transitory and Final Provisions

Section 46 Legal Validity

¹These degree programme and examination regulations come into effect on the day after their publication. ²They shall apply to all students who enter a Medical Engineering degree programme in the winter semester 2009/2010 or later.

Appendix 1

Study plan and examinations for the Bachelor's degree programme Medical Engineering

Column 1		Column 2		Column 4							Column 5
Module group	Module no.	Module		Total	1 st sem.	2 nd sem.	3 rd sem.	4 th sem.	5 th sem.	6 th sem.	Course and examination achievements
		Module name	Possible GOP modules ²⁾	ECTS credits	ECTS credits	ECTS credits	ECTS credits	ECTS credits	ECTS credits	ECTS credits	Type and scope of examination
B 1	Basics of Medicine			10	0	2.5	2.5	0	2.5	2.5	
	B 1.1	Anatomy and Physiology for Non-Medical Students		5	0	2.5	2.5	0	0	0	EA: written examination (Klausur) (90 minutes)
	B 1.2	Biomedicine and Engineering		5	0	0	0	0	2.5	0	PfE: EA: written examination (Klausur) (45 minutes) +
		Seminar: Medical Engineering			0	0	0	0	0	2.5	uCA: written report + Presentation
B2	Medical Engineering			10	5	5	0	0	0		
	B 2.1	Medical Engineering I	X	5	5	0	0	0	0	0	PfE: EA: report (approx. 10 pages) + presentation (approx. 6 min.) +
		tutorial									uCA: independent solving of tutorial exercises and/or oral/written Attestations
	B 2.2	Medical Engineering II	X	5	0	5	0	0	0	0	EA: written examination (Klausur) (90 minutes)

B 3 Mathematics and Algorithms			45	17.5	10	5	12.5	0	0	
B 3.1	Mathematics for MT 1 ¹⁾	X	7.5	7.5	0	0	0	0	0	PfE: EA: written examination (Klausur) (90 minutes) +
	tutorial									uCA: independent solving of tutorial exercises and/or oral/written attesta- tions
B 3.2	Mathematics for MT 2 ¹⁾	X	10	0	10	0	0	0	0	PfE: EA: written examination (Klausur) (120 minutes) +
	tutorial									uCA: independent solving of tutorial exercises and/or oral/written attesta- tions
B 3.3	Mathematics for MT 3 ¹⁾		5	0	0	5	0	0	0	PfE: EA: written examination (Klausur) (60 minutes) +
	tutorial									uCA: independent solving of tutorial exercises and/or oral/written attesta- tions
B 3.4	Mathematics for MT 4 ¹⁾		5	0	0	0	5	0	0	PfE: EA: written examination (Klausur) (60 minutes) +
	tutorial									uCA: independent solving of tutorial exercises and/or oral/written attesta- tions
B 3.5	Algorithms and Data Structures MT	X	10	10	0	0	0	0	0	PfE: EA: written examination (Klausur) (120 minutes) +
	tutorial									uCA: independent solving of tutorial exercises and/or oral/written attesta- tions
B 3.6	Algorithms for Continuous Systems		7.5	0	0	0	7.5	0	0	PfE: EA: written examination (Klausur) (90 minutes) +
	tutorial									uCA: independent solving of tutorial exercises and/or oral/written attesta- tions

B 4 Basics of Physics and Engineering				30	7.5	12.5	5	5	0	0	
B 4.1	Basics of Electrical Engineering I	X	7.5	7.5	0	0	0	0	0	0	EA: written examination (Klausur) (120 minutes)
B 4.2	Basics of Electrical Engineering II	X	5	0	5	0	0	0	0	0	EA: written examination (Klausur) (90 minutes)
B 4.3	Statics and Structural Mechanics	X	7.5	0	7.5	0	0	0	0	0	EA: written examination (Klausur) (90 minutes)
B 4.4	Experimental Physics I		5	0	0	5	0	0	0	0	EA: written examination (Klausur) (90 minutes)
B 4.5	Experimental Physics II		5	0	0	0	5	0	0	0	EA: written examination (Klausur) (90 minutes)
B 5 Branch of study: Imaging Techniques (ET/INF) according to catalogue of branches of study ³⁾				40	0	0	15	12.5	12.5	0	
or											
B 6 Branch of Study: Device Engineering and Prosthetics (MB/WW/CBI) according to catalogue of branches of study ³⁾				40	0	0	15	12.5	12.5	0	
B 7 Core Skill				15	0	0	2.5	0	0	12.5	
B 7.1	Laboratory training		2.5	0	0	2.5	0	0	0	0	uCA: laboratory achievement ⁴⁾
B 7.2	Free choice Uni/Soft Skills		2.5	0	0	0	0	0	0	2.5	gCA: according to applicable examination regulations/module handbook
B 7.3	Industrial placement		10	0	0	0	0	0	0	10	uCA: according to the placement guidelines for the Medical Engineering degree programme
B 8 Specialisation modules for branches of study³⁾				20	0	0	0	0	15	5	
B 8.1	Elective specialisation modules		15	0	0	0	0	15	0	0	EA³⁾
B 8.2	Elective specialisation modules		5	0	0	0	0	0	5	0	EA³⁾
B 9 Bachelor's thesis				10	0	0	0	0	0	10	EA : written assignment + presentation

w	Total ECTS credits (~150 semester hours)	180	30	30	30	30	30	30	
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PfE portfolio examination
EA examination achievement
gCA graded course achievement
uCA ungraded course achievement

- 1) The equivalency of the Mathematics modules in the degree programmes of the Faculty of Engineering shall be announced according to local practice.
- 2) The modules marked with 'X' may make up part of the preliminary examination (GOP) according to Section 38. At least one module from each of the module groups B2 to B4 must have been passed.
- 3) The catalogues of branches of study and elective modules with detailed examination requirements for each module shall be published on the Medical Engineering website before the start of the semester according to local practice.
- 4) Practice of practical tasks, written experiment protocols, and oral or written attestations.

Appendix 2: Master's study plan template Medical Engineering

No.	Module groups	ECTS credits	Recommended semester distribution ⁸⁾				Type and scope of the course and examination achievement ⁴⁾
			1.	2.	3.	4.	
M 1	Medical specialisation modules according to the catalogue of elective modules for all branches of study ^{1) 2) 3)}	10	5	5			EA: written examination (Klausur) 60/90 min. /oral examination 30 min.
M 2	Engineering core modules according to catalogue of elective modules for specific branch of study ^{2) 3)}	20	10	10			EA: written examination (Klausur) 60/90 min. /oral examination 30 min.
M 3	Medical Engineering core modules according to catalogue of elective modules for specific branch of study ^{3) 5)}	20	10	10			EA: written examination (Klausur) 60/90 min. /oral examination 30 min.
M 4	Medical Engineering core skills according to basic curriculum in catalogue of elective modules for specific branch of study ³⁾	10	5		5		EA (reports + presentations acc. to dept. specifications)
M 5	Medical Engineering specialisation modules according to catalogue of elective modules for specific branch of study ^{3) 6)}	10		5	5		EA: written examination (Klausur) 60/90 min. /oral examination 30 min.
M 6	Medical Engineering practical skills according to the catalogue of elective modules for all branches of study ³⁾	10			10		uCA (reports acc. to module descriptions and dept. specifications)
M 7	Flexible budget ⁷⁾	10			10		EA: according to applicable examination regulations
M 8	Master's thesis	30				30	EA (report + presentation)
	Total ECTS credits ⁹⁾	120	30	30	30	30	

PfE portfolio examination
EA examination achievement
gCA graded course achievement
uCA ungraded course achievement

- 1) In the branch of study Medical Image and Data Processing, international students may take equivalent English-language modules in M1, M4 and M6.
- 2) Where necessary, modules defined as admission requirements with specific skills that were not completed during the Bachelor's degree programme must be taken.
- 3) The catalogues of elective modules with detailed examination requirements for each module shall be published on the Medical Engineering website before the start of the semester according to local practice.
- 4) One examination per module. When choosing modules from the catalogue of branches of study for the Master's degree programme, a subject-specific increase in expertise compared to the preceding Bachelor's degree must be proven.
- 5) In the module group M3, modules of up to 5 ECTS credits can be transferred from the module groups M2 and M3 of all disciplines.
- 6) In the module group M5, modules of up to 5 ECTS credits can be transferred from the module groups M2–M5 of all disciplines.
- 7) In the non-consecutive programme, the Admissions Committee defines the modules that have to be taken a posteriori in the flexible budget of module group M7.
- 8) The third and fourth semesters are designed as mobility windows during which students can realise stays abroad.
- 9) Approx. 100 semester hours