Degree Program and Examination Regulations for Bachelor's and Master's Degree Program in Autonomy Technologies at the Faculty of Engineering of Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU) – FPOAT –
Dated April 26, 2023

amended by statutes of
April 30, 2024

Based on Section 9 (1) in conjunction with Section 80 (1)(1), section 84 (2)(1), Section 88 (9), Section 90 (1)(2) and Section 96 (3)(1) of the Bavarian Higher Education Innovation Act dated August 5, 2022 **(BayHIG)**, Friedrich-Alexander-Universität Erlangen-Nürnberg enacts the following degree program and examination regulations:

Contents:

Part I: General Provisions

Section 39 Scope

These degree program and examination regulations govern studying and provisions for examinations in the Bachelor's degree program in Autonomy Technologies and the consecutive Master's degree program in Autonomy Technologies leading to Bachelor of Science or Master of Science degrees and supplements the General Examination Regulations for Bachelor's and Master's Degree Programs at the Faculty of Engineering of FAU – **ABMPO/TF** – in the currently valid version.

Section 40 Bachelor's Degree Program, Teaching and Examination Language, Related Degree Programs

(1) The Bachelor's degree program in Autonomy Technologies comprises modules worth a total of 180 ECTS credits pursuant to **Appendix 1** and includes a Bachelor's thesis with a presentation.

(2) In order to enroll on the Bachelor's degree program in Autonomy Technologies, applicants must provide proof of proficiency in English equivalent to level B1+ of the Common European Framework of Reference for Languages (CEFR) (B1+ for language proficiency, B2 for reading skills).

(3) [1]Notwithstanding Section 3 (6)(1) **ABMPO/TF**, the teaching and examination language in the Bachelor's degree program in Autonomy Technologies is English. [2]Individual courses and examinations that are not compulsory modules may be conducted in German. [3]The Bachelor's thesis shall be written in English; the Degree Program Committee shall decide on any exceptions at the student's request. [4]The degree certificate and final academic record shall be issued in German and English.

(4) Section 28 (1)(2)(2) **ABMPO/TF** does not apply to related degree programs.

Section 41 Master's Degree Program, Part-time Study, Teaching and Examination Language, Related Degree Programs

(1) [1]The Master's degree program in Autonomy Technologies builds on the contents of the Bachelor's degree program in Autonomy Technologies in accordance with these degree program and examination regulations. [2]It consists of modules worth 120 ECTS credits in total pursuant to **Appendix 2** or **3** and includes a Master's thesis with a presentation.

(2) The Master's degree program in Autonomy Technologies can be completed as a full-time **(Appendix 2)** or as a part-time **(Appendix 3)** degree program.

(3) [1]Notwithstanding Section 4 (5)(1) **ABMPO/TF**, the teaching and examination language in the Master's degree program in Autonomy Technologies is English. [2]Individual courses and examinations that are not compulsory modules may be conducted in German. [3]The Master's thesis shall be written in English; the chairperson of the Degree Program Committee shall decide on any exceptions at the student's request. [4]The degree certificate and final academic record shall be issued in German and English.

(4) The provisions in Section 34 (3)(2) **ABMPO/TF** do not apply to related degree programs.

Section 42 Specializations

(1) [1]Bachelor's students in Autonomy Technologies shall choose one of the following specializations and Master's students in Autonomy Technologies shall choose two of the following specializations in order to establish a subject-specific profile.
1. Human-System Interfaces
2. Networking & Collaboration
3. Planning & Control
4. Sensing & Perception

[2]The specialization modules offered within the chosen specializations are stated in the catalog of specialization modules approved by the Degree Program Committee and are announced in accordance with local practice in the module handbook before the lecture period begins.

(2) [1]The overriding learning outcome of the specializations which can be chosen pursuant to paragraph 1 is to allow students to gain more advanced knowledge in the selected specialization. [2]This should allow them to acquire skills of relevance to research.

(3) [1]In the specialization "Human-System Interfaces", students advance their knowledge in human-machine interfaces and human-centric development for autonomous systems. [2]They acquire knowledge about human perception and information processing in order to implement corresponding interface components for input and output for a specific application (e.g. for robotics).

(4) [1]The specialization "Networking & Collaboration" considers the aspects of communication technology and signal processing for exchanging information and networking autonomous systems. [2]The knowledge imparted to the students also includes aspects of mobile communication and distributed algorithms.

(5) [1]In the specialization "Planning & Control", students acquire in-depth knowledge of dynamic decisions in autonomous systems, taking into account the ego and environment situation. [2]This includes control, optimization, and learning-based methods for influencing as well as predictive motion and decision planning of an autonomous system in a dynamically changing environment.

(6) [1]The specialization "Sensing & Perception" focuses on sensing the environment and other agents (people and systems). [2]Students acquire knowledge of the design and implementation of appropriate sensor systems based on various physical principles (e.g. wave-based and inertial) as well as suitable signal processing algorithms for the analysis and interpretation of data.

(7) [1]One examination achievement is stipulated per module. [2]Examinations in the modules shall take one of the following forms: written examination (60, 90, 120 min), oral examination (20-30 min), seminar achievement or laboratory achievement pursuant to Section 7(3) **ABMPO/TF**. [3] Section 7 (2)(3) **ABMPO/TF** stipulates that in justified exceptional circumstances, combinations of the individual achievements stated in sentence 3 may also be possible.

(8) [1]The specialization modules are generally worth 5 ECTS credits (typically lecture and tutorial are worth 4 SWS).
[2]Any exceptions to the size of the module and combinations of teaching units are detailed in the module handbook.

(9) The Degree Program Committee can approve other specializations and modules upon request, paragraph 7 applies.

Part II: Special Provisions

1. Bachelor's Examination

Section 43 Structure of the Bachelor's Degree Program
(1) [1]The Bachelor's degree program consists of compulsory, core, specialization and elective modules. The distribution across the semesters, the type and duration of the examinations and the required number of ECTS credits are stipulated in **Appendix 1**.

(2) Modules no. B1 to B25 in **Appendix 1** are compulsory.

(3) [1] The preliminary examination (Grundlagen- und Orientierungsprüfung; GOP) shall comprise modules worth 30 ECTS credits. [2]The GOP shall have been passed when the student has passed the module Mathematics I and achieved a further 22.5 ECTS credits from the modules marked "GOP" in **Appendix 1**.

(4) [1]In the fifth and sixth semester, students must choose two core modules (module group B26, 10 ECTS credits in total) and a specialization module (B27, 5 ECTS credits), a seminar and a laboratory course (module B28, 5 ECTS credits) from the specialization catalog. [2]When registering for the first examination in a module of a specialization, students select the specialization they wish to take. [3]A change of specialization shall only be permitted in justified exceptional cases with prior approval from the chairperson of the Degree Program Committee.

(5) [1]At least 5 ECTS credits must be obtained in key qualifications (modules B29 and B30). [2]The catalog is published before the beginning of the semester in accordance with local practice. [2]5 ECTS credits must be obtained from the elective modules from engineering subjects at the Faculty of Engineering (module B31). [2]5 ECTS credits must be obtained from elective modules taken from non-engineering subjects (module B32) from the degree programs offered across the University. [3]The type and scope of teaching units and examinations pursuant to Sentences 1 and 2 depend on the specific manner in which the respective module is taught and are regulated by the applicable **degree program and examination regulations** and/or the module handbook.

(6) [1]In addition, the Bachelor's degree program includes the Bachelor's thesis module pursuant to No. B33 in **Appendix 1**. [2]The degree program is completed with the Bachelor's thesis itself and a presentation of around 30 minutes.

(7) [1]Notwithstanding Section 32 (2)(3) **ABMPO/TF**, failed attempts in the modules B29 to B32 will not be counted when changing to alternative modules and it is still possible for students to change modules even after failing three attempts at the previous module. [2]In addition, in the event of a failure to pass, there is no obligation to repeat the failed examination within the legally stipulated period pursuant to Section 32 (1)(6) **ABMPO/TF**.

Section 44 Core and Specialization Modules Pursuant to the Specialization Catalog

(1) [1]The learning outcome of the core and specialization modules from the specialization catalog (B26 and B27 pursuant to **Appendix 1** and **4**) is to allow students to gain a more in-depth knowledge of selected skills such as the design and application of autonomous technologies. [2]Students gain analytical skills and can formulate mathematical descriptions for technical contexts. [3]The second learning outcome has a research focus, with students learning subject-related methods of research and exploring their subject in more depth. [4]Thirdly, the element of choice allows students to tailor their profile in view of their career plans.

(2) [1]The type and scope of the examination are dependent on the skills for the relevant module according to paragraph (1) and the module handbook. [2]Possible examinations for each module are: written examination (60 min, 90 min or 120 min) or an oral examination (30 min). [3]The catalog is published before the beginning of the semester in accordance with local practice.

(3) [1]Core and specialization modules amounting to 5 ECTS credits usually consist of a lecture (2 SWS) and a tutorial (2 SWS) or a lecture (3 SWS) and a tutorial (1 SWS). [2]Any exceptions are detailed in the module handbook.

Section 45 Seminar and Laboratory Course

(1) [1]The learning outcome of the seminar and laboratory course (module B28 pursuant to **Appendix 1**) is to allow students to gain initial insights into the topics of the areas of interest to them in their degree program pursuant to Section 42 and to gather, analyze and interpret information relevant to their subject. [2]A second learning outcome is aimed at promoting personal and social skills through preparing, reporting on and presenting a topic relating to the subject for a specialist audience at a Bachelor's degree level and in a manner tailored to suit the target group, as well as working under supervision in a group to develop and test subject-related applications and possibilities for implementation with respect to the chosen subject. [3]Thirdly, the element of choice allows students to tailor their profile in view of their career plans.

(2) [1]A seminar usually comprises 2 SWS and is completed with a graded seminar achievement. [2]A laboratory course usually comprises 3 SWS and is completed with an (ungraded) practical achievement. [3]Any exceptions to the scope of the lectures and seminars and the specific scope of the course and examination achievements are detailed in the module handbook.

(3) Section 44 (4) shall apply accordingly.

Section 46 Bachelor's Thesis

(1) Admission to the Bachelor's thesis shall be governed by Section 31 (3)(2) **AB-MPO/TF**.

(2) [1]The Bachelor's thesis is intended to enable students to learn to solve problems relating to autonomy technologies independently. [2]Anyone employed as a university lecturer as their main occupation as defined in Section 19 (1) **BayHIG** at the Faculty of Engineering and involved in this degree program as their main occupation pursuant to Section 53 (4) **BayHIG** shall be entitled to assign and supervise Bachelor's theses. [3]Exceptions to this rule may be granted by the chairperson of the Degree Program Committee. [4]Requirements for the Bachelor's thesis shall be such that it can be completed with a workload of 300 hours.

(3) 10 ECTS credits are awarded for the Bachelor's thesis module, which includes a presentation of around 30 minutes in addition to the Bachelor's thesis itself.

Section 47 Evaluation of Achievements for the Bachelor's Degree Program

(1) The Bachelor's degree program shall have been completed successfully if proof of passing all modules stipulated in **Appendix 1** has been submitted.

(2) [1]The final grade shall be calculated using all graded modules and module groups set forth in **Appendix 1** including the Bachelor's thesis, weighted with a factor corresponding to the assigned ECTS credits. [2]An interim grade shall be given for each module group in accordance with the ECTS weighting of the individual modules.

2. Master's Examination

Section 48 Qualification for a Master's Degree, Certificates and Admission Requirements

(1) [1]A subject-specific degree as defined in Section 33 (1)(1) **ABMPO/TF** is a Bachelor's degree program in Autonomy Technologies pursuant to these degree program and examination regulations or a degree from a university in Germany or another country with a skills profile equivalent to that of this degree program. [2]Other Bachelor's degrees shall be recognized as subject-related degrees within the meaning of Section 33 (1)(1) **ABMPO/TF** if they provide evidence of the following skills:
- Mathematics: At least 22.5 ECTS credits, knowledge identical to that of modules B1 to B3 of **Appendix 1** of these degree program and examination regulations
- Mechatronics and automatic control: At least 20 ECTS credits, knowledge identical to that of modules B8, B10, B11 and B16 of **Appendix 1** of these degree program and examination regulations
- Electrical engineering: At least 15 ECTS credits, knowledge identical to that of modules B4 and B5 of **Appendix 1** of these degree program and examination regulations
- Computer science: At least 20 ECTS credits, knowledge identical to that of modules B19, B20 and B24 of **Appendix 1** of these degree program and examination regulations.

(2) [1]Within the meaning of subsection (2)(6)(3) of the **Appendix** to **ABMPO/TF**, additional proof of English language skills equivalent to at least Level B2 of the Common

European Framework of Reference (CEFR) shall be provided by submitting either relevant school reports or certificates issued by a language school or university. [2]Proof of language skills can in particular be provided by submitting a school leaving certificate or a certificate issued by the school providing evidence that English lessons up to a level equivalent to B2 CEFR have been taken at school or evidence of having successfully completed the Test of English as a Foreign Language (TOEFL) with at least 80 points in the iBT or the International English Language Testing System (IELTS) with a score of 6.0 or above or other equivalent qualifications (please refer to the table of equivalence published by the FAU Language Centre). [3]Proof of language proficiency does not need to be submitted if the applicant acquired their university entrance qualification or relevant undergraduate degree in English.

(3) [1]Notwithstanding paragraph 5(2) of the **Appendix to ABMPO/TF**, applicants with a subject-specific degree shall be deemed qualified for the Master's degree program in Autonomy Technologies if:
1. The final grade of the applicant's subject-specific degree in accordance with paragraph 1(1) or the applicant's subject-specific achievements to date is better than 2.00 or
2. at least two of the following compulsory modules in the Bachelor's degree program Autonomy Technologies or modules demonstrating equivalent skills from another university have been awarded the module grade of 2.7 or better:
   a) Module "Electrical engineering I"
   b) Module "Electrical engineering II"
   c) Module "Mechatronic components and systems"
   d) Module "Sensors"
   e) Module "Signal theory"
   f) Module "Digital signal processing"
   g) Module "Dynamical systems and control"
   h) Module "Machine learning for control systems"
   i) Module "Electric drives".

[2]Applicants who have completed their Bachelor's degree at another university must submit the module descriptions for the modules named above.

(4) [1]Applicants who cannot be admitted directly to the degree program in accordance with paragraph 3 will be evaluated pursuant to the following provisions. [2]Applicants with a subject-specific degree who do not meet the requirements of paragraph 3 and applicants with a subject-related degree in accordance with paragraph 1 sentence 2, whose final grade or average grade of previous achievements is at least "good" as defined in Section 22 (4) **ABMPO/TF** will be invited to an online admissions test held in English via a secure examination platform. [3]The date for the test will be communicated to applicants at least one week in advance. [4]Notwithstanding paragraph 7 of the Appendix to **ABMPO/TF**, the test will be conducted in the form of an open-book examination lasting 60 minutes and applicants will be expected to solve tasks in the fields of human-system interfaces, networking and collaboration, planning and control, sensing and perception and general engineering mathematics, particularly analysis and linear algebra. [5]Further information about the test and about the permitted aids will be communicated to the applicants when the test date is announced; Section 31 (7)(5) **ABMPO/TF** shall apply accordingly. [6]Applicants qualify for admission if they achieve the grade "gut" (good) as defined in Section 22 (1)(1)**ABMPO/TF** or better in the test. [7]Applicants who achieve lower grades in the admission tests will be deemed unsuitable and cannot be admitted to the Master's degree program.

Section 49 Scope and Structure of the Master's Degree Program

(1) The type and scope of the module examinations in the Master's degree program are stated in **Appendix 2** (full-time) or **Appendix 3** (part-time).

(2) The Master's degree program is divided into the following areas:
1. Two core modules from each of the two chosen specializations (10 ECTS credits per specialization) pursuant to **Appendix 4**
2. Four specialization modules from the two chosen specializations (20 ECTS credits per specialization) pursuant to Section 50
3. Elective modules from the range of modules offered across the University (15 ECTS credits) pursuant to Section 51
4. Seminar and laboratory course module worth 5 ECTS credits from the range of modules offered for the two specializations pursuant to Section 52
5. A team project or industrial internship pursuant to Section 53
6. Master's thesis including presentation (30 ECTS credits) pursuant to Section 54.

(3) [1]When registering for the first examination in a module of a specialization, students select the specialization they wish to take. [2]A change of specialization shall only be permitted in justified exceptional cases with prior approval from the chairperson of the Degree Program Committee.

(4) [1]Due to the specific subject competencies that are set out in each module description and that must be acquired as part of the qualification goals of the consecutive Bachelor's and Master's degree program, each module can only be taken once during the Master's degree program. [2]If modules from the range of core modules in the specialization have already been completed during the Bachelor's degree program, they must be replaced with other modules from the entire range of specialization modules offered for the chosen specialization.

(5) [1]Notwithstanding Section 32 (2)(3) **ABMPO/TF**, failed attempts will not be counted when changing to alternative modules and it is still possible for students to change modules even after failing three attempts at the previous module. [2]In addition, in the event of a failure to pass, there is no obligation to repeat the failed examination within the legally stipulated period pursuant to Section 32 (1)(6) **ABMPO/TF**.

Section 50 Core and Specialization Modules pursuant to the Specialization Catalog

(1) [1]The learning outcome of the core and specialization modules mentioned above is to allow students to gain a more in-depth knowledge of selected skills in their specialization pursuant to Section 42. [2]The second learning outcome has a research focus, with students learning subject-related methods of research and exploring their subject in more depth. [3]Thirdly, the element of choice allows students to tailor their profile in view of their career plans.

(2) [1] The type and scope of examinations depend on the skills taught in the respective module accounting for 5 ECTS credits pursuant to paragraph 1 and the module handbook. or, if so chosen by the student, two modules worth 2.5 ECTS credits.

[2]Possible examinations for each module are: written examination (60 min, 90 min or 120 min) or an oral examination (30 min). [3]The catalog is published before the beginning of the semester in accordance with local practice.

(3) [1]Core and specialization modules amounting to 5 ECTS credits usually consist of a lecture (2 SWS) and a tutorial (2 SWS) or a lecture (3 SWS) and a tutorial (1 SWS). [2]Any exceptions are detailed in the module handbook.

Section 51 Elective Modules from the University Module Catalog

(1) 15 ECTS credits must be obtained from elective modules from the range of modules offered across the University (module M5).

(2) The type and scope of teaching units and examinations pursuant to paragraph 1 depend on the specific manner in which the respective module is taught and are regulated by the applicable **(degree program and) examination regulations** and/or the module handbook.

Section 52 Seminar and Laboratory Course

(1) [1]The first learning outcome of the seminar and laboratory course module is to allow students to expand the knowledge they have already gained in their specialization pursuant to Section 38, in particular by working on complex problems within the scope of research-oriented projects. [2]A second learning outcome is aimed at promoting personal and social skills through independently preparing, reporting on, and presenting a topic from current research and defending ideas in a discussion at the Master's level, as well as working in a group to develop and test subject-related applications and possibilities for implementation with respect to the chosen subject. [3]Thirdly, the element of choice allows students to tailor their profile in view of their career plans.

(2) [1]A seminar usually comprises 2 SWS and is completed with a graded seminar achievement. [2]A laboratory course usually comprises 3 SWS and is completed with an (ungraded) practical achievement. [3]Any exceptions to the scope of the lectures and seminars and the specific scope of the course and examination achievements are detailed in the module handbook.

Section 53 Team Project, Practical Internship

(1) [1]The learning outcome of the team project module is to allow students to learn how to put academic work to practical use in research. [2]Upon completion of the team project, students will be able to independently conduct literature research and classify and analyze literature sources. [3]Furthermore, the students in the team are able to independently discuss the task set for them from the field of autonomy technologies within a given period of time using scientific methods and develop suitable approaches and concepts for solving it. [4]In addition, they have the knowledge required to present their scientific research results in presentations and research reports.

(2) [1]An industrial internship may be completed as an alternative to the team project. [2]The industrial internship must meet the guidelines for practical training for the Master's degree program Autonomy Technologies and be recognized by the Internship Office for Autonomy Technologies.

Section 54 Master's Thesis

(1) [1]In order to qualify for admission to the Master's thesis (Module M9 in **Appendix 2** or **3**), students shall be required to successfully complete modules pursuant to **Appendix 2 or 3** worth at least 80 ECTS credits. [2]The chairperson of the Degree Program Committee may grant exceptions upon the student's request.

(2) [1]The Master's thesis is intended to demonstrate the students' ability to solve problems in autonomy technologies independently. [2]Full-time university lecturers from the Faculty of Engineering involved in this degree program shall be entitled to assign and supervise Master's theses. [3]Exceptions to this rule may be granted by the chairperson of the Degree Program Committee.

(3) The Master's thesis module includes a presentation (approximately 30 minutes) and is worth 30 ECTS credits.

(4) Notwithstanding Section 36 (6)(1) **ABMPO/TF**, the Master's thesis shall be written in English.

Section 55 Evaluation of Achievements for the Master's Degree Program

(1) The Master's degree program shall have been completed successfully if all modules stipulated in **Appendix 2** or **Appendix 3** have been passed.

(2) [1]The final grade shall be calculated using all graded modules and module groups set forth in **Appendix 2** or **3** including the Master's thesis, weighted with a factor corresponding to the ECTS credits awarded. [2]An interim grade shall be given for each module group in accordance with the ECTS weighting of the individual modules.

Part III: Final Provisions

Section 56 Legal Validity

(1) [1]These degree program and examination regulations shall come into effect on the day after their publication. [2]They shall apply to all students who start the Bachelor's or Master's degree program Autonomy Technologies in the winter semester 2023/2024 or later.

(2) [1]The first amendment statute shall come into effect on October 1, 2024. It shall apply to all students starting their degree program as of winter semester 2024/2025 and to those Master's students studying in accordance with the FPOAT dated April 26, 2023 at the time the amendment statute comes into effect. With respect to Bachelor's students studying in accordance with the FPOAT dated April 26, 2023 at the date the amendment statute comes into effect, it shall apply with the exception of the amendments in Section 43 (3) concerning the preliminary examination (Grundlagen- und Orientierungsprüfung; GOP). The provisions stipulated to date to Section 39(3) of the FPOAT dated April 26, 2023 shall continue to apply for these students and the changes in module B19 (Algorithms, programming, and data representation) shall only apply to students who have not yet started examinations in this module (first attempt).

Appendix 1: Structure of the Bachelor's Degree Program

S1	S2	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
		SWS (semester hours)					Distribution of workload per semester in ECTS credits							Pre-limi-nary ex-ami-na-tion (GOP)
No.	Module name					ECTS credits	1.	2.	3.	4.	5.	6.	Type and scope of the examination	
		L	T	P	S		WS	SS	WS	SS	WS	SS		
1. Compulsory subjects														
B 1	Mathematics I	4	2			7.5	7.5						EA (WE, 90 min)	GOP
B 2	Mathematics II	4	2			7.5		7.5					EA (WE, 90 min)	GOP
B 3	Mathematics III	4	2			7.5			7.5				EA (WE, 90 min)	
B 4	Electrical engineering I	4	2			7.5	7.5						EA (WE, 90 min)	GOP
B 5	Electrical engineering II	4	2			7.5		7.5					EA (WE, 90 min)	GOP
B 6	Introduction to MATLAB			3		2.5	2.5				-		CA (LA)	
B 7	Introduction to microwave engineering	2	2			5			5				EA (WE, 90 min)	
B 8	Mechatronic components and systems	2	2			5				5			EA (WE, 90 min)	
B 9	Electrical engineering laboratory			2		2.5				2.5			CA (LA)	
B 10	Electric drives	2	2			5			5				EA (WE, 90 min)	
B 11	Sensors	2	2			5					5		EA (WE, 90 min)	
B 12	Signal theory	3	1			5			5				EA (WE, 90 min)	
B 13	Stochastic processes	3	1			5				5			EA (WE, 90 min)	
B 14	Digital signal processing	3	1			5					5		EA (see **FPO CME**)	
B 15	Introduction to communication systems	3	1			5				5			EA (WE, 90 min)	
B 16	Dynamical systems and control"	2	2			5				5			EA (WE, 90 min)	

B 17	Machine learning for control systems	2	2			5					5		EA (WE, 90 min)	
B 18	Modeling of control systems	2	2			5					5		EA (WE, 90 min)	
B 19	Algorithms, programming, and data representation	4	2	2		10	10						EA (written examination, 120 mins) + CA (LA)	GOP
B 20	System-level programming	2	2			5		5					EA (WE, 90 min)	GOP
B 21	Embedded systems	2	2			5			5				EA (see **FPO INF**)	
B 22	Numerics for engineers I	2		2		5					5		EA (WE, 60 min)	
B 23	Simulation of autonomous systems	2	2			5				5			EA (WE, 90 min)	
B 24	Machine learning for engineers I	4				5		5					EA (WE, 90 min)	
B 25	Automation laboratory			2		2.5						2.5	CA (LA)	
	Total compulsory subjects					**135**								
2. Specialization catalog[1]														
B 26	Core modules	4	4			10					5	5	EA: see Section 44 (2)	
B 27	Specialization module or core module	2	2			5						5	EA: see Section 44 (2)	
B 28	Seminar & laboratory			3	2	5						5	EA (SA, 100%) + CA (KA, 0%)	
	Total specialization catalog modules					**20**								
3. Elective subjects and thesis														
B 29	Key qualifications I [2)3)]				2	2.5	2.5						EA: see Section 43 (5)	
B 30	Key qualifications II [2)3)]				2	2.5			2.5				EA: see Section 43 (5)	
B 31	Technical elective [2)3)]	2	2			5						5	EA: see Section 43 (5)	
B 32	Non-technical elective [2)3)]	2	2			5		5					EA: see Section 43 (5)	
B 33	Bachelor's thesis with presentation				2	10						10	EA (Bachelor's thesis and presentation, 30min) (80%+20%)	
	Total elective subjects and thesis					**25**								
	Total SWS and ECTS credits	**72**	**46**	**14**	**8**	**180**	**30**	**30–32.5**	**27.5–30**	**27.5–30**	**30**	**32.5**		

[1] Choice of four specializations.

[2] Choice of key qualifications, see Section 43 para. 5.

[3] [1]Notwithstanding Section 32 (2)(3) **ABMPO/TF**, failed attempts in the modules B29 to B32 will not be counted when changing to alternative modules and it is still possible for students to change modules even after failing three attempts at the previous module. [2]In addition, in the event of a failure to pass, there is no obligation to repeat the failed examination within the legally stipulated period pursuant to Section 32 (1)(6) **ABMPO/TF**.

Abbreviations:
GOP: preliminary examination (Grundlagen- und Orientierungsprüfung)
EA = graded examination achievement, see Section 7 (2)(10) **ABMPO/TF**.
CA = ungraded course achievement (see Section 7 (2) sentence 11) **ABMPO/TF**.
O: oral examination LA = laboratory achievement, see Section 7 (3) sentences 4 and 6 **AMBPO/TF** and module handbook
SA = seminar achievement, see Section 7 (3) sentences 5, 7 and 8 **ABMPO/TF** and module handbook

Appendix 2: Structure of the Full-time Master's Degree Program

S1	S2	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13
No.	Module name	SWS (semester hours)				ECTS credits	Distribution of workload per semester in ECTS credits				Type and scope of the examination
							1.	2.	3.	4.	
		L	T	P	AS		WS	SS	WS	SS	
M1	Specialization I: Core modules	4	4			**10**	5	5			EA, see Section 50 (2) in conjunction with **Appendix 4**
M2	Specialization I: Modules	8	8			**20**	5	5	10		EA: see Section 50 (2)
M3	Specialization II: Core modules	4	4			**10**	5	5			EA, see Section 50 (2) in conjunction with **Appendix 4**
M4	Specialization II: modules	8	8			**20**	5	5	10		EA: see Section 50 (2)
M5	Elective subjects[1]	6	6			**15**	10	5			EA: see Section 51 (2)
M6	Seminar & laboratory			3	2	**5**		5			EA (SA, 100%) + CA (LA, 0%), see Section 48
M7	Team project or industrial internship					**10**			10		CA, see Section 53
M8	Master's thesis with presentation				2	**30**				30	EA (Master's thesis and presentation 30 minutes) (90%+10%)
	Total SWS and ECTS credits	**30**	**30**	**2**	**4**	**120**	**30**	**30**	**30**	**30**	

[1]Notwithstanding Section 32 (2)(3) **ABMPO/TF**, failed attempts in module M5 will not be counted when changing to alternative modules and it is still possible for students to change modules even after failing three attempts at the previous module. In addition, in the event of a failure to pass, there is no obligation to repeat the failed examination within the legally stipulated period pursuant to Section 32 (1)(6) **ABMPO/TF**.

Abbreviations:
GOP: preliminary examination (Grundlagen- und Orientierungsprüfung)
EA = graded examination achievement, see Section 7 (2)(10) **ABMPO/TF**.
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LA: laboratory achievement, see Section 7 (3) sentences 4 and 6 **AMBPO/TF** and module handbook).
SA = seminar achievement, see Section 7 (3) sentences 5, 7 and 8 **ABMPO/TF** and module handbook

Appendix 3: Structure of the Part-time Master's Degree Program

S1	S2	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17
No.	Module name	SWS (semester hours)				ECTS credits	Distribution of workload per semester in ECTS credits								Type and scope of the examination
		L	T	P	AS		1. WS	2. SS	3. WS	4. SS	5. WS	6. SS	7. WS	8. SS	
M 1	Specialization I: Core modules	4	4			**10**	5	5							EA: see Section 50 (2) in conjunction with **Appendix 4**
M2	Specialization I: Modules	8	8			**20**	5	5	5	5					EA: see Section 50 (2)
M3	Specialization II: Core modules	4	4			**10**			5	5					EA: see Section 50 (2) in conjunction with **Appendix 4**
M4	Specialization II: modules	8	8			**20**			5	5	5	5			EA: see Section 50 (2)
M5	Elective subjects[1]	6	6			**15**	5	5			5				EA: see Section 51 (2)
M6	Seminar & laboratory			3	2	**5**					5				EA (SA, 100%) + CA (LA, 0%), see Section 48
M7	Team project or industrial internship					**10**						10			CA, see Section 53
M8	Master's thesis with presentation				2	**30**							15	15	EA (Master's thesis and presentation 30 minutes) (90%10%)
	Total SWS and ECTS credits	**30**	**30**	**2**	**4**	**120**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	

[1]Notwithstanding Section 32 (2)(3) **ABMPO/TF**, failed attempts in module M5 will not be counted when changing to alternative modules and it is still possible for students to change modules even after failing three attempts at the previous module. In addition, in the event of a failure to pass, there is no obligation to repeat the failed examination within the legally stipulated period pursuant to Section 32 (1)(6) **ABMPO/TF**.

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Appendix 4: Core modules in Bachelor and Master's degree specializations

S1	S2	S3	S4	S5	S6	S7	S8	S9
No.	**Module name**	**SWS (semester hours)**				**ECTS credits**	**WS/SS**	**Type and scope of the examination**
		L	T	P	AS			
Core modules: Human-System Interfaces								
K 1	Human-centered mechatronics and robotics	2	2			5	SS	EA (WE, 90 min)
K 2	Robot Mechanisms and User Interfaces	2	2			5	WS	EA (WE, 90 min)
K 3	Human computer interaction	3	1			5	SS	EA (WE, 90 min)
K 4	Intent detection and feedback	2	2			5	SS	EA (WE, 60 min)
Core modules: Networking & Collaboration								
K 1	Digital communications	3	1			5	SS	EA (see **FPO CME**)
K 2	Information theory and coding	3	1			5	WS/SS	EA (see **FPO CME**)
K 3	MIMO communication systems	3	1			5	SS	EA (WE, 90 min)
K 4	Machine learning in communications	3.5	0.5			5	WS	EA (K, 90 min or O, 30 min)
Core modules: Planning & Control								
K 1	Robotics I	2	2			5	SS	EA (WE, 90 min)
K 2	Nonlinear control systems	3	1			5	SS	EA (WE, 90 min)
K 3	Numerical optimization and model predictive control	3	1			5	SS	EA (WE, 90 min)
K 4	Introduction to deep learning	2	2			5	WS	EA: see FPO ASC
Core modules: Sensing & Perception								
K 1	Radar, RFID and wireless sensor systems	2	2			5	SS	EA (K, 90 min or O, 30 min)
K 2	Statistical signal processing	3	1			5	WS	EA (see **FPO CME**)
K 3	Image, video, and multidimensional signal processing	2	2			5	WS	EA (WE, 90 min)
K 4	Machine learning in signal processing	3	1			5	WS	EA (see **FPO ASC**)

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