

Study and Subject Examination Regulations
for the International Software Systems Science
Master's Degree Programme
at the University of Bamberg
of 6 March 2015

Note: Original English translation from 21.12.2022 (Ben Wilson) amended on 01.02.2023 (Michael Mendler) to reflect the changes effective from 1st of April 2023 (*11. Änderungssatzung*) to be effective from 1st October 2023 and including recently announced changes for WS 2023-2024.

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amended by:

Elfte Satzung zur Änderung der Studien- und Fachprüfungsordnung für den Masterstudiengang International Software Systems Science an der Otto-Friedrich-Universität Bamberg vom 15. März 2023 (Fundstelle:

<https://www.uni-bamberg.de/fileadmin/www.abt-studium/amtliche-veroeffentlichungen/2023/2023-21.pdf>)

Zehnte Satzung zur Änderung der Studien- und Fachprüfungsordnung für den Masterstudiengang International Software Systems Science an der Otto-Friedrich-Universität Bamberg vom 15. September 2022

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Neunte Satzung zur Änderung der Studien- und Fachprüfungsordnung für den Masterstudiengang International Software Systems Science an der Otto-Friedrich-Universität Bamberg vom 6. August 2021 (Fundstelle:

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Achte Satzung zur Änderung der Studien- und Fachprüfungsordnung für den Masterstudiengang International Software Systems Science an der Otto-Friedrich-Universität Bamberg vom 31. März 2021 (Fundstelle:

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Siebente Satzung zur Änderung der Studien- und Fachprüfungsordnung für den Masterstudiengang International Software Systems Science an der Otto-Friedrich-Universität Bamberg vom 31. März 2020

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Satzung zur Änderung der Sechsten Satzung zur Änderung der Studien- und Fachprüfungsordnung für den Masterstudiengang International Software Systems Science an der Otto-Friedrich-Universität Bamberg vom 30.

September 2019 (Fundstelle:

<https://www.uni-bamberg.de/fileadmin/www.abt-studium/amtliche-veroeffentlichungen/2019/2019-69.pdf>)

Sechste Satzung zur Änderung der Studien- und Fachprüfungsordnung für den Masterstudiengang International Software Systems Science an der Otto-Friedrich-Universität Bamberg vom 14. August 2019

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<https://www.uni-bamberg.de/fileadmin/www.abt-studium/amtliche-veroeffentlichungen/2019/2019-43.pdf>)

Fünfte Satzung zur Änderung der Studien- und Fachprüfungsordnung für den Masterstudiengang International Software Systems Science an der Otto-Friedrich-Universität Bamberg vom 17. April 2019 (Fundstelle:

<https://www.uni-bamberg.de/fileadmin/www.abt-studium/amtliche-veroeffentlichungen/2019/2019-26.pdf>)

Vierte Satzung zur Änderung der Studien- und Fachprüfungsordnung für den Masterstudiengang International Software Systems Science an der Otto-Friedrich-Universität Bamberg vom 12. Oktober 2018

(Fundstelle: <https://www.uni-bamberg.de/fileadmin/www.abt-studium/amtliche-veroeffentlichungen/2018/2018-70.pdf>)

Dritte Satzung zur Änderung der Studien- und Fachprüfungsordnung für den Masterstudiengang International

Software Systems Science an der Otto-Friedrich-Universität Bamberg vom 4. Oktober 2017

(Fundstelle:

<https://www.uni-bamberg.de/fileadmin/www.abt-studium/amtliche-veroeffentlichungen/2017/2017-66.pdf>)

Zweite Satzung zur Änderung der Studien- und Fachprüfungsordnung für den Masterstudiengang International Software Systems Science an der Otto-Friedrich-Universität Bamberg vom 30.

September 2016

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Satzung zur Änderung der Studien- und Fachprüfungsordnung für den Masterstudiengang International

Software Systems Science an der Otto-Friedrich-Universität Bamberg vom 30. September 2015

(Fundstelle:

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Disclaimer: This English translation is provided for informational purposes. The English text was carefully translated and reviewed for accuracy. In the event that the English and German version permit different interpretations, the German text shall prevail.

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In accordance with Article 13 Paragraph 1 Clause 2 in conjunction with Article 58 Paragraph 1 Clause 1 and Article 61 Paragraph 2 Clause 1 of the Bayerische Hochschulgesetz (BHschG, Bavarian Higher Education Act), the University of Bamberg issues the following

Study and Subject Examination Regulations

I. General regulations

§29

Scope of application

- (1) These study and subject examination regulations comprise regulations for the International Software Systems Science master's degree programme.
- (2) The International Software Systems Science master's degree programme is a consecutive, advanced master's degree programme that follows and builds upon a bachelor's degree in computer science, software systems science or another closely related degree programme comprising at least 180 ECTS points.
- (3) These study and subject examination regulations supplement the general examination regulations (APO) for bachelor's and master's degree programmes in the University of Bamberg's Faculty of Information Systems and Applied Computer Science (§§1 through 28).

§30

Programme duration and credit scope

- (1) ¹The standard programme duration in the International Software Systems Science master's degree programme is four semesters of study. ²At least 120 ECTS points are required for successful completion of the degree programme.
- (2) The maximum permitted duration of study is six semesters.

§31

Related degree programmes

¹As defined by §5 of the general examination regulations of the Faculty of Information Systems and Applied Computer Science (APO WIAI), degree programmes related to the International Software Systems Science master's programme are degree programmes situated in the computer science subject field (particularly bioinformatics, computer and communications technology, computer science, computational and computer engineering, media informatics, medical informatics, information systems). ²In individual cases, the examining board shall decide whether a degree programme is considered to be related.

§32

Module handbook

¹As a rule, the examination board shall adopt a module handbook for the coming academic year by the end of the summer semester and announce it to the university. ²The module handbook contains descriptions of the modules of the Faculty of Information Systems and Applied Computer Sciences in accordance with these study and subject examination regulations and regulates the contents in detail, in particular: Contents and learning objectives, forms of teaching, applicability of modules, credit hours per week, volume of work, frequency and duration of a module as well as specification of examination regulations.

II. Final examination and module examination

§33

Programme admission requirements

- (1) Admission to the International Software Systems Science master's degree programme stipulates that candidates possess a degree from an institution of higher education or an equivalent degree comprising at least six semesters of study and 180 ECTS points with a final mark of at least 2.7 in a programme in the same field of study.
- (2) ¹In addition, admission to the International Software Systems Science master's degree programme is open to students possessing a university degree or an equivalent degree with a standard period of study of at least six semesters and comprising 180 ECTS points and an overall mark of at least 2.7 in a related degree programme according to § 31; it must impart competences comprising at least 115 ECTS points and corresponding to the modules of module groups A1, A2, A3 and A4 of the University of Bamberg's Software Systems Science bachelor's degree programme. ²The competences required according to sentence 1 include
 - competences in the fields of mathematics, theoretical foundations of computer science or software analysis comprising at least 34 ECTS points,
 - competences in the fields of programming, software engineering or algorithms and data structures comprising at least 33 ECTS points,
 - competences in the fields of database systems, computers and operating systems, information security, distributed systems, data communication or mobile systems comprising at least 36 ECTS points,
 - further competences in the field of mathematics or computer science comprising at least 12 ECTS points.
- (3) ¹Furthermore, admission to the International Software Systems Science master's degree programme requires verification of English language proficiency at a level suitable for a

programme taught in English. ²English proficiency is to be verified by at minimum IELTS 6.5 or TOEFL (internet-based) 90 level, or equivalent language certificates.

- (4) ¹Applicants according to paragraph 1 shall be permitted to commence their studies before they have fulfilled the admission requirements stipulated in paragraph 1, provided that at least 150 ECTS points of the qualifying degree programme have been obtained.

²Achievement of the admission requirements must be verified by the end of the second semester. ³If verification is not provided in due time, the student shall be exmatriculated ex officio. ⁴The exmatrication shall take effect at the end of the second semester.

§34

Purpose of the master's programme

(1) ¹The International Software Systems Science master's degree programme leads to a further, advanced academic degree. ²During the programme, it is determined whether a student has acquired advanced knowledge and specialised expertise, has a firm understanding of the subject's contexts and possesses the skills required to independently apply the subject's scientific methods and insights to the solution of complex problems and to their further development through research.

(2) In the programme, students must take module examinations for the module groups listed in § 40, taking into account the specified electives and including the completion of the master's thesis.

(3) The module groups are assigned the ECTS points specified in Appendix 1.

§35

Master's thesis

(1) ¹The master's thesis is meant to verify that the examination candidate is capable of utilising scientific and scholarly methods in an independent pursuit of the assigned topic.

(2) The topic of the master's thesis shall be drawn from one of the subject groups specified in Appendix 2. ²Upon the examination candidate's request, the examining board may also approve a topic from another subject group. ³In such a case, the examination candidate must satisfactorily show that the content of the proposed topic is drawn from Software Systems Science.

(3) ¹The master's thesis module includes a colloquium in which the principal findings the thesis are defended. ²At the student's choice, the colloquium takes place either prior to or after assessment of the master's thesis.

(4) The final mark for the master's thesis is calculated based on the following components: 67 % of the total derives from the assessment written thesis and 33 % from the colloquium, in which the principal findings of the thesis are defended.

- (5) Admission to the master's thesis requires successful completion of modules comprising at least 60 ECTS points.

§36

Specialisation field

¹The elective fields of specialisation are listed in Appendix 3. ²This list also contains the corresponding modules for each specialisation field. ³Upon application to the examining board, a specialisation field can be included in the transcript if

- a) the master's thesis in module group A4,
 - b) a seminar or a project in module group A3 and, additionally,
 - c) at least 18 ECTS points from the module groups A1 and A2
- have been earned in the corresponding field.

§37

International experience

- (1) Students in the International Software Systems Science master's degree programme are strongly advised to complete structured studies abroad or an internship in an international context totalling at least 360 hours, usually in the second or third semester of study.
- (2) ¹Students are responsible for arranging their own studies or internship abroad. ²The University of Bamberg's International Office provides assistance with the arrangement of foreign studies within the framework of established university partnerships and available aid programmes. ³There is no entitlement to placement in a foreign study programme.
- (3) ¹An internship in an international context is a subject-specific internship in the professional field of software systems science, which is to be completed in an international context, preferably abroad. ²The internship may be completed in a foreign or internationally operating domestic enterprise (or research institution) in private or public ownership. ³An internship shall be chosen in such a way that the educational objectives of § 39 paragraph 1 are met. ⁴Verification of the internship shall take the form of a completion certificate issued by the department or organisational unit in which the internship was completed, as well as an internship report of at least four DIN-A4 pages in length. ⁵The certificate and report are to be submitted to the examining board. ⁶Diverging from sentence 2, students who have completed their qualifying initial studies entirely outside of Germany may also complete the internship at other domestic enterprises or research institutions.
- (4) ¹Prior to beginning studies abroad, examinations to be taken during the structured study period at a foreign institution of higher education shall be defined together with the responsible examining board (Learning Agreement). ² During studies abroad, modules can be completed which either correspond to a module offered at the University of Bamberg according to Appendix 1 of these Study and Subject Examination Regulations (no significant differences with regard to the competences acquired) or can be assigned to one of the

module groups A1 to A3 according to Appendix 1. ³Completed courses which have been repeated during studies abroad cannot be credited a second time. ⁴In all other respects, § 6 of the general examination regulations of the Faculty of Information Systems and Applied Computer Sciences (APO WIAI) applies concerning the recognition of credits earned during studies abroad.

III.

Programme prerequisites, objectives and structure

§38

Programme prerequisites

Pursuant to these regulations, courses and module examinations shall be held and completed in English.

§39

Programme objectives

- (1) ¹Building consecutively on a relevant bachelor's degree programme, the master's degree programme provides specialisation in the field of software sciences as well as qualification for a research-related professional activity in the academic or industrial environment of computer science. ²The subject matter of software systems science comprises computer science-based fields of activity required for the creation of complex distributed and networked software systems.
- (2) ¹Over the course of the degree studies, students gain knowledge, skills and competences pertaining not only to the fields of software systems science and computer science but also to the associated neighbouring and auxiliary disciplines. ²In this context, the integration of these various fields of knowledge and their application to topics in software systems science is of particular significance.
- (3) ¹The programme is both method- and project-oriented and is meant to prepare students for a diverse range of professional opportunities. ²The options available in the core studies provide the opportunity for the development of individual specialisation fields.
- (4) ¹Additionally, the programme is intended to convey the skills required for the continued self-education necessitated by the dynamic nature of the software systems science field. ²Furthermore, the programme is also designed to convey the skills necessary to contribute to the continued advancement of the field within the context of research and development activities.

- (5) Based on its English-language course offering, the programme also provides the opportunity to utilise existing passive and active language skills in the subject-specific context of software systems science, and to learn the extensive technical English terminology used in this field.
- (6) The International Software Systems Science master's degree programme also aims to further strengthen qualifications for working internationally by providing the opportunity to pursue optional, integrated foreign studies or an optional subject-specific internship in an international context.

§40

Programme structure

- (1) Students in the International Software Systems Science master's degree programme gain skills and expertise in the following five module groups:
 - A1: Software Systems Science
 - A2: Domain-specific Software Systems Science
 - A3: Seminar and Project
 - A4: Master's Thesis
 - A5: International Experience
- (2) ¹Module groups A1 and A2 offer specialisation in software systems science and related computer science subjects. ²Modules from the module groups A2, A3 and A4 of the University of Bamberg's Software Systems Science bachelor's degree programme, in which the necessary subject-related prerequisites for master's degree modules in groups A1 or A2 are conveyed, can be selected in the module groups A1 and A2 up to a total of 12 ECTS points. ³Modules that teach the respective subject-specific prerequisites are listed in the module handbook under the heading 'Recommended prior knowledge'. ⁴Other modules from the bachelor's degree programme can be selected after a corresponding application to the examining board and if the prerequisites detailed in sentence 2 are fulfilled.
- (3) Within the A1 module group, depending on the current course offerings, further modules can be selected from the following subjects: algorithms and complexity theory, data engineering, foundations of computer science; communication systems and computer networks; mobile software systems/mobility; software technology and programming languages; information security; as well as distributed systems and systems programming.
- (4) In the A2 module group, depending on the current course offerings, additional modules from related computer science subjects of relevance to software systems science can be selected.
- (5) ¹The A3 module group contains one seminar in computer science or applied computer science and one project from the field of software systems science according to appendix 2a

that expand on and apply the content of the A1 and A2 module groups.² The topics addressed in this module group offer an advanced exploration of specific issues relating to software systems science.

- (6) The A4 module group provides for the in-depth examination of an advanced topic from a subject in computer science or another subject in accordance with Appendix 2 within the scope of the master's thesis.
- (7) In the A5 module group, there is an option to complete an internship in an international context and/or modules at a foreign university.

IV. Final provisions

§41

Entry into force

These regulations enter into force on the day of their promulgation.

Appendix 1: Modules and module groups in the International Software Systems Science master's degree programme

¹120 ECTS points, including the master's thesis, must be earned for completion of the International Software Systems Science master's degree programme. ²The International Software Systems Science degree programme comprises the module groups A1 through A5. ³In accordance with the character of the degree programme, these module groups are required elective fields that allow students to develop individual areas of specialisation. ⁴The following shall detail how the degree programme's required ECTS points are distributed among the module groups.

	Module group	ECTS
A1	Software Systems Science	36 – 54
A2	Domain-specific Software Systems Science	0-18
A3	Seminar and Project	9
A4	Master's Thesis (topic pursuant to Appendix 2)	30
A5	International Experience	27
	Total	120

⁵In module groups A1 and A2, modules totalling 54 ECTS points must be completed in compliance with the minimum and maximum limits applicable in the respective module group.

1. Module Group A1 Software Systems Science

In module group A1, modules amounting to 24 ECTS points must be completed in the compulsory area and modules totalling between 12 and 30 ECTS points must be completed in the required elective area from the following offering.

ID	Module Title	ECTS	Examination
Compulsory: 24 ECTS points			
MOBI-DSC-M	Data Streams and Complex Event Processing	6	Oral or written examination
SWT-CPS-M ¹	Cyber-Physical Systems	6	Written examination
DSG-DSAM-M	Distributed Systems Architecture and Middleware	6	Term paper and colloquium
KTR-GIK-M	Foundations of Internet Communication	6	Term paper and colloquium

Required electives: 12 to 30 ECTS points			
DSG-DistrSys-M	Distributed Systems	6	Term paper and colloquium
DSG-SOA-M	Service-Oriented Architecture and Web Services	6	Term paper and colloquium
SYSNAP- OSE-M	Operating Systems Engineering	6	Oral examination
SYSNAP- Virt-M	Virtualisierung (Virtualization)	6	Written or oral examination
GdI-FPRS-M	Functional Programming of Reactive Systems	6	Written or oral examination
KTR-MAKV-M	Modelling and Analysis of Communication Networks and Distributed Systems	6	Oral examination
KTR-MMK-M	Multimedia Communication in High Speed Networks	6	Oral examination
KTR-Mobi-M	Mobile Communication	6	Oral examination
MOBI-ADM-M	Advanced Data Management	6	Written examination
SWT-ASV-M	Applied Software Verification	6	Term paper and colloquium
SWT-SWQ-M ¹	Software Quality	6	Written examination
PSI-AdvaSP-M	Advanced Information Security and Privacy	6	Written examination
AISE-UL	Universelle Logik & Universelles Schließen (Universal Logic & Universal Reasoning)	6	Written or oral examination
DT-DBCPU-M	Database Systems for modern CPU	6	oral
AlgoK-Algo	Algorithmen	6	Written or oral examination
² The module catalogue can be expanded by comparable subject-related modules in the module handbook.			

¹**IMPORTANT CHANGE WS23-24:** The module SWT-CPS-M is no longer offered. To fulfill the compulsory requirement of module group A1 the module SWT-SWQ-M must be attended.

2. Module Group A2 Domain-specific Software Systems Science

¹In the A2 module group, modules in the range of 0 to 18 ECTS points must be completed from the following offering. The modules marked in the column 'rT' require regular participation.

ID	Module Title	ECTS	Examination	rT
EESYS-ES-M	Energy-Efficient Systems	6	Written examination	
EESYS-ADAML-M	Applied Data Analytics and Machine Learning in R	6	Written examination	
HCI-MCI-M	Human-Computer Interaction	6	Written or oral examination	

HCI-US-B	Ubiquitous Systems	6	Written or oral examination	
VIS-IVVA-M	Advanced Information Visualization and Visual Analytics	6	Written examination	
SME-STE-M¹	Introduction to Knowledge Representation: Space, Time, Events	6	Oral examination	
SNA-OSN-M	Project Online Social Networks	6	Term paper and colloquium	x
² The module catalogue for the required elective can be expanded by comparable subject-related modules in the module handbook.				

¹**IMPORTANT CHANGE WS23-24:** The module SME-STE-M is no longer offered.

3. Module Group A3 Seminar and Project

¹In the A3 module group, both a seminar module in computer science or applied computer science comprising 3 ECTS points and a software systems science project module according to appendix 2a comprising 6 ECTS points are required. ²The seminar module's examination takes the form of a presentation and a written term paper. ³The project module's examination takes the form of a written term paper and a colloquium. ⁴Regular attendance as per § 9 chapter 10 of the general examination regulations of the Faculty of Information Systems and Applied Computer Science (APO WIAI) is required in the selected courses for admission to the respective module examination.

4. Module Group A4 Master's Thesis

¹¹According to § 35, the A4 module group requires the master's thesis module with a credit value of 30 ECTS points. ²The module examination is completed in a written paper with a processing time of six months and a colloquium with an examination duration of 20 to 60 minutes.

5. Module Group A5 International Experience

The A5 module group requires modules totalling 27 ECTS points.

a. Required elective: structured studies abroad

¹Modules comprising 0 to 27 ECTS points and completed within the framework of structured studies at a foreign university abroad can be included in required elective area a, provided that they differ substantially from the modules to be completed according to the specifications of these regulations and that their subject matter can be systematically allocated to module groups A1, A2 or A3.

²Module credits can be credited for competences at master's level as well as credits at bachelor level

up to 12 ECTS, in order to fulfil recommended prerequisites for modules in module group A1 or A2 in pursuant to § 40 Abs. 2 Satz 2.

b. Required elective: internship

¹In required elective area b, an internship in an international context can be completed with a credit value of 12 ECTS points. ²The internship must comply with the requirements of § 37.

ID	Module Title	ECTS	Examination
SSS-PraktIntKon-M	International internship	12	Internship report (not marked)

c. Required elective: foreign languages

¹In required elective area c, modules comprising 0 to 15 ECTS points can be completed from the Bamberg Language Centre's offering or from foreign universities in the context of structured studies abroad pursuant to 5a. ² Modules in English and modules in the language in which the university entrance qualification was acquired are exempt. ³Details, in particular modules available for selection as well as respective module examinations and partial module examinations, are specified in the University of Bamberg's examination regulations and the module handbook for practical language modules.

d. Required electives

If less than 27 ECTS points are earned in required elective areas 5a to 5c, further, not yet completed modules from the required elective areas of module groups A1 or A2 must be completed.

Appendix 2: Master's thesis topics in the International Software Systems Science master's degree programme

The topic of the master's thesis (credited with 30 ECTS points) may be drawn from one of the following subjects:

a) Subjects from the Computer Science subject group:

- Algorithms and complexity
- Data engineering
- Foundations of computer science,
- Communication services, telecommunication systems and computer networks,
- Mobile software systems/mobility,
- Privacy and security in information systems,
- Software technologies and programming languages,
- Distributed systems,
- Systems programming.

b) Subjects otherwise related to the International Software Systems Science master's degree programme that have a strong connection to software systems science.

Concerning letter b) above, an examination candidate's proposed topic must be approved by the examining board. The official proposal to the board should satisfactorily show that the topic exhibits a thematic connection to the content of the International Software Systems Science master's degree programme.

Appendix 3: Specialisation fields in the International Software Systems Science master's degree programme

¹In the International Software Systems Science master's degree programme one of the four following specialisation fields may be chosen:

- S1: Distributed and Mobile Systems
- S2: Software Analysis and Verification
- S3: Service-oriented Architectures
- S4: Communication Systems and Protocols

²The table below presents the specialisation field classification of regularly offered modules. ³Based on a student's request, the examining board shall determine the appropriate specialisation field classification for modules not appearing in the table. ⁴The examining board shall publish an appropriate request form. ⁵Upon request by the student, specialisation field classification for modules completed during structured studies abroad can be defined in learning agreements.

ID	Module Title	ECTS	S1	S2	S3	S4
DSG-DSAM-M	Distributed Systems Architecture and Middleware	6	x			
DSG-IDistrSys*	Introduction to Distributed Systems	6	x		x	x
DSG-DistrSys-M	Distributed Systems	6	x		x	x
DSG-SOA-M	Service-Oriented Architecture and Web Services	6			x	
DSG-SRDS-M	Selected Readings in Distributed Systems	3	x		x	
EESYS-ES-M	Energy Efficient Systems	6			x	
EESYS-DAE-M	Data Analytics in Energy Informatics	6			x	
Gdl-CaS-M*	Communication and Synchronisation	6	x	x		x
Gdl-IaS-M*	Information and Security	6	x	x		x
Gdl-FP-M* (Gdl-IFP*)	Functional Programming	6		x		
Gdl-AFP-M*	Advanced Functional Programming	6		x		
Gdl-FPRS-M	Functional Programming of Reactive Systems	6	x	x		
Gdl-MTL*	Modal and Temporal Logic	6		x		
HCI-MCI-M	Human-Computer Interaction	6	x		x	
HCI-US-B	Ubiquitous Systems	6	x			
ISDL-SOA	SOA-Governance and Evaluation	3			x	
KInf-SemInf-M*	Semantic Information Processing	6			x	x
KTR-GIK-M	Foundations of Internet Communication	6			x	x
KTR-MAKV-M	Modeling and Analysis of Communication Networks and Distributed Systems	6	x	x		x
KTR-MMK-M	Multimedia Communication in High Speed Networks	6				x

Issued on 6 March 2015 in accordance with the resolution passed on 10 December 2014 by the Senate of the University of Bamberg and with the permission of the President of the University of Bamberg pursuant to Article 13 Paragraph 2 Clause 2 and Article 61 Paragraph 2 Clause 1 of the Bavarian Higher Education Act (*Bayerisches Hochschulgesetz, BayHSchG*)

Bamberg, 6 March 2015

Prof. Dr. Dr. habil. Godehard Ruppert

President

These statutes were set down in writing on 6 March 2015 in the University of Bamberg and made known on the same day by being placed on display in the University. The date of their promulgation is, therefore, 6 March 2015.