OFFICIAL TRANSLATION OF

Fachspezifische Bestimmungen für den Studiengang „Intelligent Adaptive Systems“ (M.Sc.) (Amtliche Bekanntmachung Nr. 55 vom 2. August 2018)

THIS TRANSLATION IS FOR INFORMATION ONLY – ONLY THE GERMAN VERSION SHALL BE LEGALLY VALID AND ENFORCEABLE!

Subject-Specific Provisions for the Master of Science (MSc) in Intelligent Adaptive Systems

dated 4 April 2018

Preamble

These Subject-Specific Provisions supplement the Faculty of Mathematics, Informatics and Natural Sciences' examination regulations dated 11 April 2012 and 4 July 2012, as amended, governing Master of Science degree programs and provide a description of the modules for the Master of Science in Intelligent Adaptive Systems.

I. Supplementary provisions to MSc examination regulations

Section 1
Program and examination objectives, academic degree, and implementation of the degree program

Section 1 subsection 1:

(1) The Master of Science in Intelligent Adaptive Systems degree program is a consecutive and research-based degree program taught in English.

(2) The Master of Science in Intelligent Adaptive Systems degree program follows the general program goals set out in Section 1 subsection 1 of the MSc examination regulations.

(3) The Master of Science in Intelligent Adaptive Systems degree program enhances students' abilities:

- to independently apply informatics knowledge and skills, especially in the area of intelligent and adaptive systems;
- to learn and apply scientific methods of informatics to their work;
- to act responsibly, especially with regard to the effects of technological change and social implications; and
- to communicate in English about subject-specific matters and to exchange ideas in an inter-cultural environment.

(4) The Master of Science in Intelligent Adaptive Systems degree program enhances the students' abilities to conduct research-based scientific work.

Section 1 subsection 4:
This degree program is administered by the Faculty of Mathematics, Informatics and Natural Sciences.

Section 4
Program and examination structure

Section 4 subsections 2 and 3:
(1) Detailed descriptions of all modules can be found in Appendix A to these Subject-Specific Provisions and in the module course catalog.

(2) The Master of Science in Intelligent Adaptive Systems degree program consists of a required area (51 ECTS credits), a required elective area (24 ECTS credits), an unrestricted elective area (15 ECTS credits), and a master's thesis final module (30 ECTS credits).

(3) Required courses include the modules for Software Architecture (InfM-SA, 6 ECTS credits), Bio-Inspired Artificial Intelligence (InfM-BAI, 6 ECTS credits), Intelligent Robotics (InfM-IR, 6 ECTS credits) Neuronal Networks (InfM-NN, 6 ECTS credits), Machine Learning (InfM-ML, 9 ECTS credits), Research Methods (InfM-RM, 6 ECTS credits), and a project with an integrated seminar (Project) (InfM-Proj, 12 ECTS credits) for a total of 51 ECTS credits.

(4) 24 ECTS credits must be earned from the required elective area. The required elective modules to choose from are set forth in more detail in Appendix A to these Subject-Specific Provisions and in the module course catalog. In the required elective area either 3 or 6 ECTS credits, respectively, may be taken within the scope of the module Independent Study (InfM-IS/IAS), however the maximum number of ECTS credits for independent study may not exceed six in total. An application to recognize other suitable modules for credit in addition to the required elective area modules described in Appendix A to these Subject-Specific Provisions and in the module course catalog may be submitted to the responsible examinations board.

(5) 15 ECTS credits must be earned from the unrestricted elective area. In the unrestricted elective area either 3 or 6 ECTS credits may be taken in the Independent Study (InfM-IS/IAS) module, whereby the module Independent Study from the required elective area may not be credited. The examinations board may make recommendations for electives.

(6) An overall maximum total of 12 ECTS credits may be earned for the module Independent Study (InfM-IS/IAS) in the required elective area and the elective area.

(7) On a case by case basis, the examinations board shall decide on whether work from a previous bachelor's degree program or a comparable master's degree program will be allowed credit. Considers in this regard are particularly based on whether prior work can be adapted to the qualification objectives of the master's degree program and warrant that students are unable to take the same or essentially identical courses with respect to content in a module in a bachelor's degree program and then again in a master's degree program.

Curriculum for MSc in Intelligent Adaptive Systems:

First semester	Software Architecture	Bio-Inspired Artificial Intelligence	Intelligent Robotics	Research Methods	Required elective
Second semester	Neuronal Networks	Machine Learning	Required elective	Required elective	Elective area
Third semester	Project	Seminar	Required elective	Elective area	Elective area
Fourth semester	Final Module (master's thesis)				

Section 5
Course types

Section 5 sentence 2:
(1) Modules consist of either pure lecture modules or combinations of lectures and an (integrated) seminar or (integrated) practical course.

(2) Project modules consist of combinations of projects and a respective integrated seminar.

Section 5 sentences 3 and 4:
In justified cases, attendance is mandatory for all courses apart from lectures.

Section 5 sentence 5:
Courses will be held in English.

Section 13
Completed coursework and module examinations

Section 13 subsection 4:
As a rule written examinations last 120 minutes. Oral examinations last between 20 and 30 minutes. More information is contained in Appendix A. Any changes will be announced before registration for the module.

Section 13 subsection 6:
The examination shall be in English. If the examiner and the student agree, the examination may also be taken in a language that is different from the language of the module.

Section 14
Master's thesis

Students who have earned at least 72 ECTS credits in total may be admitted to the final module. The examinations board must decide on any exceptions.
A mandatory component of the final module is a colloquium consisting of a presentation and an academic discussion about the subject matter of the thesis. The presentation is one tenth of the grade for the final module, which must receive a passing grade of at least 4.0. The presentation should be given no later than six weeks after submission of the thesis.

Section 14 subsection 4 sentence 2:
The master's thesis must be written in English.

Section 14 subsection 5:
The master's thesis amounts to 30 ECTS credits. The master's thesis must be completed within six months.

Section 15
Evaluation of examinations

Section 15 subsection 3 sentence 5:
If a module examination is comprised of multiple testing components, then the (overall) grade for the module is calculated on the basis of the average grades for respective performance weighted according to the ECTS credits assigned to each part. This does not apply to the final module. Calculation of the final module grade is governed by Section 14.

Section 15 subsection 3 sentences 10 and 11:
The overall grade earned for the master's degree program is calculated on the basis of the average of the grades from the modules weighted according to the ECTS credits

assigned to them plus the grade from the final module and excluding ECTS credits that have been earned in the elective area.

Section 15 subsection 4:
The overall grade "pass with distinction" is awarded if a grade of 1.0 is awarded for the final module, the average overall grade is less than or equal to 1.3, and none of the module grades for the required or required elective modules is greater than 2.0.

II. Module descriptions

Descriptions of all of the modules can be found in Appendix A to these Subject-Specific Provisions and in the module course catalog.

Section 23
Effective date

These Subject-Specific Provisions shall become effective on the day following official publication by Universität Hamburg. They shall first apply to students commencing their studies in the Winter Semester 2018/2019.

Hamburg, 2 August 2018
Universität Hamburg

						Courses				Examinations			
Recommended Semester	**Frequency**	**Duration (1 or 2 semesters)**	**Module Type: Required (Req.), Required Elective (RE), or Elective (E)**	**Module Number/Code**	**Module Prerequisites**	**Module**	**Course Title**	**Type of Course**	**Cr. Hrs.**	**Examination prerequisites**	**Type of Examination**	**Graded**	**ECTS Credits**
Schedule of required modules The following modules must be taken: InfM-BAI, InfM-IR, InfM-ML, InfM-NN, InfM-Proj, InfM-RM, InfM-SWA, InfM-MA/IAS 81													
1	WiSe	1	Req.	InfM-SWA	Recommended: Programming knowledge in an object-oriented programming language	**Software Architecture**				None	Generally a written examination; oral examination as exception*	Yes	6
						Software Architecture		L	2				
						Architecture-Centric Software Development		PC/Sem	2				
Learning objectives: - Students have a sound comprehension of the requirements for software architecture as a component of the development of complex systems - They possess basic knowledge of the methods, principles, techniques, and procedures in the development of software architectures													
1	WiSe	1	Req.	InfM-BAI	None	**Bio-Inspired Artificial Intelligence**				None	Generally an oral examination; written	Yes	6

									examination as exception*		
						Bio-Inspired Artificial Intelligence	L	2				
						Bio-Inspired Artificial Intelligence	Sem	2				
Learning objectives: Students are familiar with the scientific investigation and utilization of intelligent behavior in nature: - They know the principles of biological intelligent strategies - They can critically analyze the relevant characteristics - They can implement computer models for intelligent systems and robots												
1	WiSe	1	Req.	Inf M-IR	Recommended: Foundations of knowledge processing	**Intelligent Robotics**			None	Generally an oral examination; written examination as exception*	Yes	6
						Intelligent Robotics	L	2				
						Intelligent Robotics	Sem	2				
Learning objectives: - Students know about the physical forms of perception with regard to their application in robotics - They can apply sensor-based techniques in robotics and other technical systems - Students have mastered basic techniques of intelligent systems and learn about their possible applications in technical systems												
1	WiSe	1	Req.	Inf M-RM	None	**Research Methods**			None	Generally an oral examination; written examination as exception*	Yes	6
						Research Methods	L	2				

						Research Methods	PC / Sem	2				
Learning objectives: The students have a deep understanding of scientific methods and their application in the field of informatics and artificial intelligence: - They know the basic principles of scientific research - They can define and conduct experiments - They can test hypotheses and carry out their statistical evaluation												
2	SoSe	1	Req.	Inf M-NN	Recommended: Knowledge of bio-inspired artificial intelligence	**Neural Networks**			None	Generally an oral examination; written examination as exception*	Yes	6
						Neural Networks	L	2				
						Neural Networks	Sem	2				
Learning objectives: Students possess a deep understanding of artificial neural networks and their integration into informatics architectures. They can analyze and understand complex problems and develop adequate solutions for them.												
2	SoSe	1	Req.	Inf M-ML	Recommended: Basic knowledge of linear algebra, stochastics, and data mining	**Machine Learning**			None	Generally a written examination; oral examination as exception*	Yes	9
						Machine Learning	L	4				
						Machine Learning	PC / Sem	2				
Learning objectives: - Students have in-depth knowledge of the different approaches to learning from data, including the relevant limitations - They possess the ability to evaluate learning methods comparatively with regard to specific application conditions - They possess the ability to systematically classify new procedures - They possess the ability to design, implement, and evaluate a learning system for a given task - They possess the ability present empirical findings in the field of machine learning												

2 and/ or 3	WiSe and SoSe	1 or 2	Req.	Inf M-Proj	Individual projects may recommend specific subject matter prerequisites	**Project**			Presentation, term paper, active project participation	Conclusion of the project	Yes	12
						Project (concerning various topics)	Proj	6				
						Integrated seminar (concerning various topics)	Sem	2				
Learning objectives: - Students are able to grapple with new problems and to solve sophisticated informatics challenges using scientific methods (under supervision) in a team - They possess advanced abilities to autonomously work on technical subject matter from source literature - They know how to present issues and solutions formulated themselves and by others both orally and in writing												
4	WiSe and SoSe	1	Req.	Inf M-MA/ IAS	Obligatory: See Section 14 MIN-PO as well as Section 14 FSB	**Final Module**			See Section 14 FSB	Master's thesis (90%) and presentation (10%)	Yes	30
						Master's thesis and a presentation in a colloquium						
Learning objectives: - Students possess the ability to work independently on a complex, scientific problem from the field of informatics using scientific methods - They possess advanced problem-solving skills and the ability to transfer the theoretical and methodological knowledge of informatics to new areas of application - They are able to scientifically evaluate and classify their own work against the background of current research work regarding the chosen topic - They are able to document problem analyses, approaches to solutions, and empirical findings in accordance with scientific standards - They are able to present, scientifically evaluate, and discuss the approaches to solutions both verbally and in writing												
Schedule of required elective modules												

	WiSe and SoSe		RE		See module descriptions	**Required elective modules**			In accordance with the provisions of the respective module description		Yes	24
						Selection from the modules InfM-CV 1, InfM-CV 2, InfM-DIS, InfM-IS/IAS, InfM-LT, InfM-RT, InfM-SSV, InfM-UIST, InfM-WV						
	WiSe	1	RE	Inf M-CV 1	None	**Computer Vision I**			None	Generally a written examination; oral examination as exception*	Yes	6
						Computer Vision I	L	2				
						Computer Vision I	PC / Sem	2				
Learning objectives: Students know the basics of digital image processing and computer vision, reinforced through practical exercises.												
	SoSe	1	RE	Inf M-CV 2	Recommended: Computer vision (module InfM-CV 1)	**Computer Vision II**			None	Generally an oral examination; written examination as exception*	Yes	6
						Computer Vision II	L	2				
						Computer Vision II	PC / Sem	2				
Learning objectives: Students possess in-depth knowledge about current research topics regarding image processing and are able to independently apply this knowledge to their individual research in this area.												

	SoSe	1	RE	Inf M-DIS	Recommended: In-depth knowledge of the relational database model (ER modeling, normalization, relational algebra, SQL); basic knowledge of managing semi-structured data (XML, XML schema, XML query languages); basic knowledge of formal logic (Horn clause logic, predicate calculus)	**Databases and Information Systems**			None	Generally a written examination; oral examination as exception*	Yes	9
						Databases and Information Systems	L	4				
						Databases and Information Systems	PC / Sem	2				

Learning objectives:

- Students possess in-depth knowledge of the basic principles, concepts, and methods of data management, processing, and analysis

- They have a better understanding of how to handle data and information
- They are able to conceptualize and implement database and information systems
- They possess the ability to adapt database systems to specific application requirements
- They know about the options for integrating database solutions into complex software systems (data warehouses or web-based, distributed information systems).

	WiSe and SoSe	1	RE	Inf M-IS/IAS	None	**Independent Study**			None	Generally a presentation and a term paper with one overall grade (100%)	Yes	3 or 6
						Supervised Project Study (can be used either within the scope of 3 ECTS credits or 6 ECTS credits, respectively; more than once to a maximum of 6 ECTS credits in the required elective area)	-					
Learning objectives: **- Students possess the ability to independently expand and deepen their knowledge and skills in the field of intelligent adaptive systems** - They can independently analyze problems and develop proposals for solutions using informatics concepts while placing special emphasis on intelligent adaptive systems - They are able to present results in writing and in the context of a presentation												
	SoSe	1	RE	Inf M-RT	Recommended: Foundations of knowledge processing	**Robot Technology**			None	Generally an oral examination; written examination as exception*	Yes	6
						Introduction to Robotics	L	2				
						Introduction to Robotics	PC	1				

						Robot Practical Course	Int	1				
Learning objectives: **- Students possess knowledge about the basic principles and the theoretical foundations for the realization of robotic systems** - They can utilize and develop components for real robots												
	SoSe	1	RE	Inf M-SSV	Recommended: Foundations of speech signal processing	**Speech Signal Processing**			None	Generally an oral examination; written examination as exception*	Yes	6
						Speech Signal Processing	L	2				
						Speech Signal Processing	PC	2				
Learning objectives: Students are able to - explain the basics of speech generation, speech perception, and speech analysis - understand the mathematical and information-theoretical principles of speech signal processing - apply the methods learned and explain the operation of practical speech signal processing systems												
	SoSe	1	RE	Inf M-LT	Recommended: Basic knowledge of automated language processing; basic knowledge of machine learning	**Language Technology**			None	Generally a written examination; oral examination as exception*	Yes	6
						Language Technology	L	2				
						Language Technology	PC	2				
Learning objectives: **- Students possess in-depth knowledge in selected areas of machine processing of natural language**												

- They are able to assess the viability and transferability of natural language processing methods - They are familiar with and understand the current state of research												
	WiSe	1	RE	Inf M-UIST	Recommended: Knowledge of human and computer interaction and interaction design	**User Interface Software and Technology**			None	Generally a written examination (60 minutes); oral examination as exception*	Yes	6
						User Interface Software and Technology	L	2				
						User Interface Software and Technology	PC	2				
Learning objectives: Students understand how different software and hardware components of interactive user interfaces work and learn about their potential and limitations. Students are able to advance their theoretical knowledge through practical application on small prototypes and in doing so examine new interaction concepts. Students are also able to evaluate these systems.												
	WiSe	1	RE	Inf M-WV	Recommended: Foundations of knowledge processing and logic	**Knowledge Processing**			None	Generally an oral examination; written examination as exception*	Yes	6
						Knowledge Processing	L	2				
						Knowledge Processing	Sem	2				
						Subject also possible as a lecture (3 credit hours per week) and seminar						

						(1 credit hour per week)						
Learning objectives: **- Students have a deeper understanding of how to handle data, information, and knowledge for complex domains** - They possess the ability to analyze requirements and select suitable, i.e. adequate and efficient knowledge processing concepts - Students possess the ability to comprehend complex problems and to develop adequate solutions in the field of intelligent systems												
	WiSe and SoSe		W		See module descriptions	**Free elective area**			In accordance with the provisions of the respective module description		as per elective	15
						A total of 15 ECTS credits for the module The examinations board may make recommendations for electives.						

Explanation: The prerequisites for participation in a module are divided into:

- Mandatory prerequisites—other modules, which must be completed before being allowed to start the module, i.e., passing the respective examinations
- Recommended prerequisites—prerequisites that do not necessarily need to be completed before commencement of the module

Key:

Int = internship

Proj = project

Sem = (integrated) seminar

PC = practical course / Int-PC = integrated practical course

L = Lecture

WiSe = winter semester / SoSe = summer semester

Cr = ECTS Credits
Cr. Hrs = credit hours per week
FSB = Subject-Specific Provisions for the Master of Science in Intelligent Adaptive Systems / MIN-PO = Master of Science Examination Regulations for the MIN Faculty
Generally an oral examination; written examination as exception* = type of examination will be announced prior to module registration.
Generally a written examination; oral examination as exception* = type of examination will be announced prior to module registration.