Non-official Version

Appendix 5
Degree-specific appendix for the Master's degree in the Engineering of Socio-Technical Systems

dated 08/10/2020[1]

(1) Supplement to Section 2: Learning outcomes

1) Academic and professional qualification: The English-taught Master's degree programme in Engineering of Socio-Technical Systems (EngSTS) is a specialised scientific curriculum. To be admitted to this programme, students must have completed a Bachelor's degree in Computing Science or Psychology. The courses take an interdisciplinary approach to the development of safety-critical, computer-based interactive systems, and particularly focus on the interaction between humans and technology. They combine content from the neurosciences with methods used by engineers to develop information systems. This Master's degree programme offers students a unique chance to follow an integrated curriculum of Computing Science and Psychology courses, especially cognitive psychology and psychology of perception.

Students on this programme gain an in-depth understanding of the principles and methods of computing science and cognitive sciences, as well as their applications, as necessary for the development of reliable socio-technical systems. By the end of the programme, students will understand the methods, problems and results of the latest research in this field. They are able to evaluate theories and methods, process models, tools and systems according to scientific criteria and use them to solve practical problems. They will also be able to apply this knowledge to solve complex and new problems. They will acquire expert knowledge about the design, specification, implementation, optimisation, validation, operation, further development and safety analyses of complex socio-technical systems, and be able to apply and manage the application of this knowledge to solve problems systematically. They will learn how to work as part of transdisciplinary teams to determine and document the requirements of existing and new application domains, to translate them into appropriate socio-technical system solutions, to implement those solutions and assess their characteristics. They will acquire in-depth knowledge of current methods of system development, and especially learn how to work as a team to develop complex socio-technical hardware/software systems. They will be able to work responsibly and conscientiously and be aware of the social impact of technical and socio-technical system solutions.

Graduates of this degree programme have also learned how to work as part of a group as well as present their own or others' results convincingly. They are well prepared to take on leadership roles in teams and at companies. They are also familiar with the current state of research in the systematic development of reliable socio-technical system solutions, making them equally qualified for work in industrial and academic research and development.

In addition to the specific technical skills, graduates are also able to analyse and solve problems using scientific methods and to use their professional judgement as engineers to recognise and deal with contradictions and deficiencies. They have acquired the necessary skills to abstract problems in an appropriate way, critically question the applicability of existing methods and, if necessary, further develop them in order to solve engineering problems using existing, innovative or even advanced methods and to develop corresponding products. By the end of the programme they will have mastered the constructive approaches of engineering as well as the relevant empirical methodology of both natural and social sciences. They are also able to critically evaluate and analyse data obtained in experiments and research projects.

[1] There may be transitional regulations for this degree-specific appendix, which may also affect you in your course of studies. Please refer to the official version of the Regulations (Section II) in the Official Notices at: https://www.uni-oldenburg.de/amtliche-mitteilungen/ for more information.

2) Areas of employment for graduates of this degree programme: Graduates of this programme are well prepared for jobs in sectors which focus on the development of interactive and cooperative systems based on information technology and cyber-physical systems. Such socio-technical systems make significant contributions to our future security, efficiency, comfort and health, and are essential technologies in the economically important domains of Smart Mobility, Smart Maritime, Smart Grid, Smart Production, Smart Home and Smart Health. This includes a number of traditional industries, such as mechanical engineering, device and equipment manufacturing, the automotive, aerospace and maritime industries, and the development of medical devices and information systems and services.

Graduates of this programme go on to work at companies in these and other industries as usability or safety engineers and human-factor engineers, or are responsible for developing interaction concepts, user interfaces and cooperation strategies.

The three tracks of the Master's degree programme give students the opportunity to specialise in different aspects of the design and development of socio-technical systems. Students who choose to follow the *Human-Computer Interaction* track focus on the design of interactive systems in the context of user-centred design processes and apply the relevant methods and principles to develop usable interactive systems. Students of the *Embedded Brain-Computer Interaction* track typically go on to develop sensors and actuators for direct interaction with the human brain as well as assistance systems that use brain-computer interactions. Graduates of the *Systems Engineering* track often work in research, development and safety analysis of cyber-physical systems and have successful careers in consulting, system analysis, design and implementation in various technical and commercial sectors.

Many graduates also choose to continue their academic research in this up-and-coming discipline by completing a PhD, either in Germany or abroad.

(2) Supplement to Section 5: Duration, scope and structure of the academic programme, ECTS credit points, part-time study

1. Scope and structure of the academic programme

The Engineering of Socio-Technical Systems programme has a total student workload of 120 ECTS credit points and is divided into:

- Basic skills modules (Fundamental Competences), with a total student workload of 18 ECTS
- Foundations of Socio-Technical Systems Engineering modules, with a total student workload of 24 ECTS
- Modules from one of the specialisation tracks (Embedded Brain Interaction, Human-Computer Interaction or Systems Engineering), with a total student workload of 48 ECTS. These are divided as follows:
    - 24 ECTS for the Practical Accentuation section
    - 12 ECTS for the Computing Science Accentuation section and
    - 12 ECTS for the Application Domains and Domain-Specific Processes Accentuation section
- The Master's thesis module has a student workload of 30 ECTS.

2. Modules

2.1 Basic skills (18 ECTS)

Students must earn 18 ECTS from Basic skills modules. The Fundamental Competences in Computing Science is offered to those students who completed their Bachelor's degree in Psychology or another related subject. It introduces them to the basics of mathematics and computing science. The Fundamental Competences in Psychology is offered to those students who completed their Bachelor's

degree in Computing Science or another related subject. It introduces them to the basics of cognitive science, psychology and empirical research. The Admissions Board decides which of the modules are compulsory for admission. The Admissions Board may individually determine further adjustment modules that serve to improve professional qualifications. If students from a previous study programme show significant interdisciplinary previous knowledge whose contents cover both computer science and psychology, fewer than three compulsory modules from the area of basic skills may be specified. In this case, the missing CP are to be achieved by other freely selectable modules of the Engineering of Socio-Technical Systems Master's programme, which are then credited in the area of Fundamental Competences.

Module code	Module title	ECTS credit points
Fundamental Competences in Computing Science (18 ECTS)		
inf960	Fundamental Competences in Computing Science I: Signals and Dynamical Systems	6
inf961	Fundamental Competences in Computing Science II: Mathematics	6
inf962	Fundamental Competences in Computing Science III: Algorithms and Computational Problem Solving	6
Fundamental Competences in Psychology (18 ECTS)		
inf970	Fundamental Competences in Psychology I: Psychology	6
inf972	Fundamental Competences in Psychology III: Experiments and Studies	6
inf977	Fundamental Competences in Psychology II: Experimental Psychology (& Cognitive Processes)	6
Total		**18**

2.2 Foundations of Socio-Technical Systems Engineering (24 ECTS)

Foundations of Socio-Technical Systems Engineering covers the principles of neuroscience, psychology and computing science. The following modules, with a total student workload of 24 ECTS, are compulsory.

Module code	Module type	Module title	ECTS credit points
inf963	Compulsory	Foundations of Socio-Technical Systems Engineering: Cognitive Processes	6
inf964	Compulsory	Foundations of Socio-Technical Systems Engineering: Psychology and Philosophy of Technology	6
inf965	Compulsory	Foundations of Socio-Technical Systems Engineering: Systems Engineering	6
inf966	Compulsory	Foundations of Socio-Technical Systems Engineering: Statistics and Programming	6
Total			**24**

2.3 Specialisations

In the second and third semester of the Master’s degree, students are required to specialise in one of the tracks: Human-Computer Interaction, Embedded Brain-Computer Interaction or Systems Engineering.

On each of the tracks, the modules are split into Accentuation areas: Computing Science (12 ECTS), Practical (24 ECTS) and Application Domains and Domain-Specific Processes (12 ECTS).

The Practical Accentuation section is interdisciplinary and promotes teamwork through internships. In each of the specialisation tracks, the Computing Science Accentuation section focuses on related topics within the traditional core areas of computing science. The Application Domains and Domain-Specific Processes Accentuation section provides in-depth insights into the requirements and particularities of different application domains. In the chosen specialisation a total of up to 6 CP from the Computer Science modules "Specific Topics" [“Spezielle Themen”] (inf374, inf375, inf596, inf597, inf584, inf585,

inf484, inf485, inf358, inf359, inf354, inf355, inf710, inf711, inf170, inf171, inf588, inf589, inf174, inf175, inf366, inf367, inf350, inf351, inf178, inf179, inf182, inf183, inf690, inf692, inf693) and "Current Topics" [“Aktuelle Themen”] (inf376, inf377, inf598, inf599, inf586, inf587, inf486, inf487, inf360, inf361, inf361, inf356, inf357, inf712, inf713, inf172, inf173, inf590, inf591, inf176, inf177, inf368, inf369, inf494, inf495, inf352, inf353, inf180, inf181, inf184, inf185, inf694, inf695, inf696, inf697) in accordance with Annex 2 can be inserted in one of the Accentuation areas.

2.3.1 Specialisation: Human-Computer Interaction

Module code	Module type	Module title	ECTS credit points
Accentuation: Computing Science (12 ECTS)			
inf301	Elective	Machine-oriented Systems Engineering	6
inf305	Elective	Medical Technology	6
inf307	Elective	Robotics	6
inf330	Elective	Embedded Systems	6
inf338	Elective	Design of Autonomous Systems	6
inf460	Elective	Security	3
inf461	Elective	Security of Cyber-Physical Systems	3
inf532	Elective	Introduction to Cognitive Engineering	6
inf535	Elective	Computational Intelligence I	6
Accentuation: Practical (24 ECTS)			
inf100	Compulsory	Human-Computer Interaction	6
inf131	Compulsory	Advanced Topics in Human-Computer Interaction	6
inf174	Compulsory	Special Topics in Media Informatics and Multimedia Systems I	6
inf175	Compulsory	Special Topics in Media Informatics and Multimedia Systems II	6
Accentuation: Application Domains and Domain-Specific Processes (12 ECTS)			
inf303	Elective	Fuzzy Control and Artificial Neural Networks in Robotics and Automation	6
inf308	Elective	Microrobotics II	6
inf333	Elective	Sensor Technology in the Automotive Domain	6
inf336	Elective	Application Area Automotive	6
inf522	Elective	Information Processing in Biomedical Research	6
inf523	Elective	Medical Software Engineering	6
inf536	Elective	Computational Intelligence II	6
inf537	Elective	Intelligent Systems	6
inf551	Elective	Maritime Systems	6
inf650	Elective	Transport Systems	6
inf663	Elective	Application Area Maritime	6
inf604	Elective	Business Intelligence I	6
inf607	Elective	Business Intelligence II	6
mar364	Elective	Time Series Analysis	6
inf975	Elective	(Neuro) Cognitive Psychology in the wild II	3
inf657	Elective	Product Engineering	6

2.3.2 Specialisation: Embedded Brain-Computer Interaction

Module code	Module type	Module title	ECTS credit points
Accentuation: Computing Science (12 ECTS)			
inf300	Elective	Hybrid Systems	6
inf301	Elective	Machine-oriented Systems Engineering	6
inf311	Elective	Low Energy Systems Design	6
inf334	Elective	System Level Design	6
inf338	Elective	Design of Autonomous Systems	6
inf456	Elective	Real-Time Systems	6
inf460	Elective	Security	3
inf461	Elective	Security of Cyber-Physical Systems	3
inf532	Elective	Introduction to Cognitive Engineering	6

Accentuation: Practical (24 ECTS)			
inf100	Elective	Human-Computer Interaction	6
inf331	Elective	Automated and Connected Driving	6
inf332	Elective	Practice Robotics	6
inf533	Elective	Probabilistic Modelling I	3
inf534	Elective	Probabilistic Modelling I	3
inf973	Compulsory	Psychology practicum fNIRS, EEG	6
inf335	Elective	Strategy Synthesis	6
inf536	Elective	Computational Intelligence II	6
inf974	Compulsory	Human-Computer Interaction and Brain-Computer Interfacing	6
Accentuation: Application Domains and Domain-Specific Processes (12 ECTS)			
inf303	Elective	Fuzzy Control and Artificial Neural Networks in Robotics and Automation	6
inf305	Elective	Medical Technology	6
inf307	Elective	Robotics	6
inf308	Elective	Microrobotics II	6
inf333	Elective	Sensor Technology in the Automotive Domain	6
inf336	Elective	Application Area Automotive	6
inf522	Elective	Information Processing in Biomedical Research	6
inf523	Elective	Medical Software Engineering	6
inf535	Elective	Computational Intelligence I	
inf537	Elective	Intelligent Systems	6
inf551	Elective	Maritime Systems	6
inf650	Elective	Transport Systems	6
inf663	Elective	Application Area Maritime	6
inf976	Elective	Auditory Scene Analysis in Speech and Music	3
inf604	Elective	Business Intelligence I	6
inf607	Elective	Business Intelligence II	6
mar364	Elective	Time Series Analysis	6
inf975	Elective	(Neuro) Cognitive Psychology in the wild II	3

2.3.3 Specialisation: Systems Engineering

Module code	Module type	Module title	ECTS credit points
Accentuation: Computing Science (12 ECTS)			
inf301	Elective	Machine-oriented Systems Engineering	6
inf311	Elective	Low Energy System Design	6
inf307	Elective	Robotics	6
inf335	Elective	Strategy Synthesis	6
inf330	Elective	Embedded Systems	6
inf334	Elective	System Level Design	6
Accentuation: Practical (24 ECTS)			
inf900	Elective	Project group	24
inf903	Elective	Research project I	12
Inf300	Elective	Hybrid Systems	6
inf338	Elective	Design of Autonomous Systems	6
inf454	Elective	Communicating and Mobile Systems	6
inf456	Elective	Real-Time Systems	6
inf460	Elective	Security	3
inf461	Elective	Security of Cyber-Physical Systems	3
inf502	Elective	Simulation	6
inf533	Elective	Probabilistic Modelling I	3
inf534	Elective	Probabilistic Modelling II	3
inf536	Elective	Computational Intelligence II	6
inf657	Elective	Product Engineering	6
Accentuation: Application Domains and Domain-Specific Processes (12 ECTS)			
inf303	Elective	Fuzzy Control and Artificial Neural Networks in Robotics and Automation	6
inf305	Elective	Medical Technology	6

inf307	Elective	Robotics	6
inf308	Elective	Microrobotics II	6
inf333	Elective	Sensor Technology in the Automotive Domain	6
inf336	Elective	Application Area Automotive	6
inf522	Elective	Information Processing in Biomedical Research	6
inf523	Elective	Medical Software Engineering	6
inf537	Elective	Intelligent Systems	6
inf551	Elective	Maritime Systems	6
inf650	Elective	Transport Systems	6
inf535	Elective	Computational Intelligence I	6
inf604	Elective	Business Intelligence I	6
inf607	Elective	Business Intelligence II	6
mar364	Elective	Time Series Analysis	6
inf975	Elective	(Neuro) Cognitive Psychology in the wild II	3
inf663	Elective	Application Area Maritime	6

Note on the Systems Engineering specialisation:

- Students must take one of the following modules: inf900 and inf903

2.4 Master's thesis module

Module code	Module type	Module title	ECTS credit points
mam	Compulsory	Master's thesis module	30

(3) Supplement to Section 22: Master's thesis module

1. As part of the Master's thesis module (30 ECTS), students write a Master's thesis which is related to one of the above-mentioned specialisations. Students are supported throughout the Master's thesis module by a regular supervisor. Students are also required to participate in an accompanying seminar and defend their work in a final colloquium. They also receive advice and guidance on how to conduct academic work.

2. The Master's thesis must be written in English.