Module INF-EXP-951: Cyber-Physical System Fundamentals (CPSF)					
Rota anually in summer term		Duration 1 semester	Stage see resp. syllabus	Credits* 6	Workload 180 (90/90)
1	Module Structure				
	No	Module / Course	Type	Credits*	SWS
	1	Cyber-Physical System Fundamentals	V	4	4
	2	Cyber-Physical System Fundamentals Lab	P	2	2
2	Language: english				
3	Content The course is based on the presenter's book on the subject and includes the following topics: 1. Introduction: Definition of terms, scope of the course 2. Specification and modeling: models of computation, communication models, finite state machines, data flow, discrete event models, von-Neumann-models, expressiveness of models 3. CPS hardware: hardware-in-the-loop, sampling and A/D-conversion, processing, field-programmable gate arrays (FPGAs), communication hardware, D/A-conversion, sampling theorem, output 4. Standard software: embedded operation systems, real-time operation systems, priority inversion, middleware 5. Evaluation and validation: objective functions, Pareto-optimality, worst-case execution time, energy consumption, reliability, real-time calculus, verification 6. Mapping of applications to execution platforms: standard optimization techniques, real-time scheduling, rate monotonic scheduling, earliest deadline first scheduling, hardware/software partitioning, mapping of applications to heterogeneous multiprocessors 7. Selected optimations <u>Literature</u> • Peter Marwedel: Embedded System Design – Cyber Physical System Fundamentals, Springer 2010 • Lego Mindstorm NTX technical documentation • Technical documentation for the used finite state mashine design tool (StateMate or similar)				
4	Goals Students successfully finishing the course should be able to • understand how cyber-physical (CPS) hardware interacts with CPS software and use this knowledge to design CPS software, • select models of computation and programming languages that are appropriate for a given design problem, • select an appropriate scheduling technique for embedded systems, • apply hardware/software codesign techniques in order to optimize the system which they are supposed to design.				
5	Examinations *Module examination:* written examination *Course achievement:* • successful completion of element 2 The course achievement is a prerequisite for the module examination.				
6	Type of Examination ☒ Module Examination ☐ Cumulative Examinations				
7	Requirements† *–none if attended as a master's degree course –*				

*Bitte beachten Sie, dass die Leistungspunkte je nach Prüfungsordnung abweichen können.

† Bitte beachten Sie, dass die Teilnahmevoraussetzungen je nach Prüfungsordnung abweichen können.

8	**Module Type and Allocation to Curriculum** see regulations for the resp. degree Students can either obtain credit points for this module or INF-BSc-232 „Eingebettete Systeme (ES)“, but not for both.		
9	**Responsible** Prof. Dr. J.-J. Chen	**Department** Computer Science	Beschluss Fakultätsrat 24.09.2014 bearbeitet 29.10.2014 / FTB