DISTRIBUTED AND NETWORKED CONTROL					AR-228
Rota annually SS	**Duration** 1 Semester	**Semester** 2nd (Semester)	**SWS** 3 SWS	**Credit Points** 5	**Workload** 150 h

1	**Modul Structure**				
	Course (Abbreviation)	**Type/ SWS**	**Presence**	**Self Study**	**Credit Points**
	c) Distributed and Networked Control	Lecture/ 2 SWS	25 h	40 h	3
	d) Distributed and Networked Control	Tutorial/ 1 SWS	15 h	40 h	2
	e) Distributed and Networked Control	Practical training			
2	**Language** English				
3	**Content** **Element 1** Introduction to distributed control and networked systems • Cyber-physical systems • Application domains • Examples Algebraic graph theory • Directed graphs and their description • Matrix representation of graphs • Analysis tools for graphs Consensus in multi-agent control • Control design for consensus • Convergence analysis • Leader-follower networks Synchronisation • Modelling and interpretation of coupling structures • Linear and nonlinear settings • Kuramoto oscillators • Power-swing equations Research outlook and case studies **Lehrinhalte Elemente 2 und 3** • Black board exercises, in class computer exercises **Literature:** • Jan Lunze, Networked Control of Multi-Agent Systems, Bookmundo Direct, 2019, ISBN: 9789463867139 • Francesco Bullo, Lectures on Network Systems, 2Kindle Direct Publishing, 2019, ISBN: 978-1986425643				
4	**Competencies** The students are able to formulate and to solve problems of modelling and control of networked control systems and distributed control. The students are able to understand and to analyze the interplay of problem formulation, modelling and system-theoretic solution ap-				

	proaches. They know how to apply and to implement distributed and decentralized control schemes for networked linear systems. The students are able to analyze consensus phenomena and synchronization mechanisms arising in coupled systems.
5	**Examination Requirements** Oral exam (max. 30 minutes) or written exam (90 minutes)
6	**Formality of Examination** ☒ Module Finals ☐ Accumulated Grade
7	**Module Requirements (Prerequisites)** • Basics of control engineering (state space description, LQR control, Lyapunov functions) • Basics of ordinary differential equations
8	**Allocation to Curriculum:** Program: Automation & Robotics; Field of study: **Process Automation**, **Robotics**, **Cognitive Systems**
9	**Responsibility/ Lecturer** Prof. Dr.-Ing. Timm Faulwasser