

Smart Grids					AR-314
Rota	Duration	Semester	SWS	Credit Points	Workload
annually SS	1 Semester	2 nd (Semester)	4 SWS	6	180 h
1	Modul structure				
	Course (Abbreviation)	Type/ SWS	Presence	Self study	Credits
	a) Smart Grids (SG)	Lecture/ 3 SWS	45 h	90 h	5
	b) Smart Grids (SG)	Presentation / 1 SWS	10 h	35 h	1
2	Language: English				
3	<p>Content</p> <p>In the past years the energy system has changed drastically. Due to environmental and political reasons, the power generation from renewable energy resources is increasing while conventional power plants are being shut down. This not only means a change of adopted technologies but also a change of the power flow direction in the electrical grid. The uncertainties of the renewable energy resources have to be properly dealt with using appropriate strategies, algorithms and technologies. This has to be done in order to avoid system instabilities causing complete or partial system blackouts.</p> <p>This course will handle the following aspects of the changing electrical energy network:</p> <ol style="list-style-type: none"> 1. Renewable Energy Technologies 2. Microgrids 3. Distribution Grid Planning 4. Flexibility and Smart Meters 5. Voltage Regulation 6. State Estimation 7. Protection and control functions 8. Grid Automation 9. Electro-mobility <p>Literature</p> <p>CIGRE WG C6.22: "Microgrids 1 Engineering, Economics, & Experience", Technical Report 635, 2015; https://www.dena.de/fileadmin/dena/Dokumente/Themen_und_Projekte/Energiesysteme/dena-Studie_Systemdienstleistungen_2030/dena_Ancillary_Services_Study_2030.pdf Smart Grids: Hadjsaid, Nouredine a. Jean-Claude Sabonnadiere, Wiley-ISTE, 2012, ISBN: 9781848212619</p>				
4	<p>Competencies</p> <p>The students successfully finishing the course should be able to</p> <ul style="list-style-type: none"> • understand the challenges in today's and future electrical energy distribution grids • comprehend the multiple areas of research done in the distribution grids • develop new solution approaches for energy system problems based on their acquired knowledge. 				
5	<p>Examination Requirements</p> <p>Dependent on the number of participants the final exam is takes place as oral (30 min) or written exam (90 min).</p>				
6	<p>Formality of Examination</p> <p><input checked="" type="checkbox"/> Module Finals <input type="checkbox"/> Accumulated Grade</p>				
7	<p>Module Requirements (Prerequisites)</p> <p>Basic knowledge in Electrical Energy Engineering</p>				
8	<p>Allocation to Curriculum:</p> <p>Program: Automation & Robotics, Field of study: Process Automation, Robotics, Cognitive Systems</p>				
9	<p>Responsibility/ Lecturer</p> <p><i>Dr.-Ing. Ulf Häger/ Dr.-Ing. Ulf Häger</i></p>				