Module Manual
of the Master Program Renewable Energy and E-Mobility (REEMM)
of the University of Applied Science Stralsund

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Compulsory Modules

The following table entries in the line "Regular Semester" refer to the Master with a standard period of study of three semesters In the case of the Master with a standard study period of four semesters, the term "Regular Semester" in the Master's thesis increases by one semester.

Course	**REEMM1300 - System Theory**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM1300 - System Theory**		
	Language	English, optional German possible		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	2nd semester	Regular semester	2nd semester
	Duration	1 semester	frequency	Annual
			compulsory / elective	Compulsory
Educational methods/SWH	Methods	Lecture and follow-up course work, exercise		
	Number SWH	0 lectures + 2 seminar-style tuition + 2 exercise + 0 laboratory + 0 seminar		
Work load	Presence study	64 h contact time		
	Self-study	116 h preparative and follow-up course work, individual studies, examination preparation		Σ 180 h
ECTS-points		6		
Prerequisite according study regulations				
Additional recommended requirements		Basic knowledge in control engineering and physics, Laplace transformation, differential and integral calculus		
Examination procedure		Written exam 2 h (Klausur 2 h)		
Learning outcomes		Students should acquire well founded system theoretical knowledge, i.e. describe and analyze dynamic systems as well as apply the methods to SISO and MIMO-systems and to be able to apply their system theory knowledge to problems of communications engineering and control technology		
Content		Description of linear time-invariant systems in the time and frequency domain; Analysis of analogue and time-discrete SISO and MIMO systems in the state space (controllability, observability and stability), state controller and observer design, method for system analysis		
Literature /references		Franklin, G.F.; Powell, J. D.; Emami-Naeini, A.: Feedback Control of Dynamic Systems, Pearson; 7 edition, 2017. Goodwin, G. C.; Graebe F. S.; Salgado, M. E.: Control System Design, , Pearson, 2001. Steffenhagen, B. :Kleine Formelsammlung Regelungstechnik, Carl Hanser Verlag 2010. Further literature will be announced during the course.		

Course	**REEMM1400 - Renewable Energy Systems**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM1400 - Renewable Energy Systems**		
	Language	English, optional German possible		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	1st semester	Regular semester	2nd semester
	Duration	1 semester	frequency	Annual
			compulsory / elective	compulsory
Educational methods/SWH	Methods	Lecture, exercise and follow-up course work, seminar		
	Number SWH	0 lectures + 2 seminar-style tuition + 2 exercise + 0 laboratory + 0 seminar		
Work load	Presence study	64 h contact time		
	Self-study	116 h preparative and follow-up course work, individual studies, examination preparation		Σ 180 h
ECTS-points		6		
Prerequisite according study regulations				
Additional recommended requirements				
Examination procedure		Written exam 2 h and certificate of laboratory work (Klausur 2 h und Übungsschein)		
Learning outcomes		The students have acquired knowledge about the theoretical description, technical possibilities and practical implementation problems in the transition from conventional to regenerative decentralized energy supply systems by intensifying their methodological knowledge. They are able to systematically apply the acquired abilities and knowledge in the profession.		
Content		Installation and planning of regenerative energy generators - offshore and onshore technology - energy storage - power grid integration - island grid configuration - intelligent grid protection - grid control and monitoring – frequency stability in distribution networks –- optimization process for decentralized energy management		
Literature /references		Quaschning, V.: Understanding Renewable Energy Systems; Earthscan/Routledge London, 2nd edition 2016. Quaschning, V.: Renewable Energy and Climate Change; John Wiley & Sons, Ltd Chichester, 1st edition 2010. Lund, H.: Renewable Energy Systems, Elsevier, 2nd Edition 2014. Kaltschmitt, M.; Streicher, W.; Wiese, A.: Renewable Energy Technology, Economics and Environment, Springer Verlag, 2007. Further literature will be announced during the course.		

Course	**REEMM2010...2050 - Elective Modules (AO) I to V**			Quality/Degree: Master Sc.	
	Course, symbol, title	**REEMM2010, REEMM2020, REEMM2030, REEMM2040, REEMM2050** **Elective Modules I to V**			
	Language	English, optional German possible			
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility			
	Semester	1st or 2nd or 3rd semester	Regular semester	2nd semester (3S, 4SwIS) 3rd semester (4SwoIS)	
	Duration	1 semester	frequency	Annual	
			compulsory / elective	compulsory	
Educational methods/SWH	Methods	Lecture and follow-up course work, exercise, seminar, laboratory			
	Number SWH	4			
Work load	Presence study	64 h contact time			
	Self-study	116 h preparative and follow-up course work, individual studies, examination preparation			Σ 180 h
ECTS-points		6			
Prerequisite according study regulations					
Additional recommended requirements					
Examination procedure		In accordance with the examination procedure defined for the chosen module in the FPO			
Learning outcomes		The students acquire complementary skills as well as profound knowledge in the selected fields: • current topics of renewable energies • wind power plants • hydrogen technology • solar systems • control of electrical drives • electro mobility • advanced power electronics • sustainable non-fossil mobility • vehicle simulation • vehicle management systems depending on the current range of elective modules and the interests of the students			
Content		Courses are offered according to §6 of the regulations of study programme or from the above-mentioned topic pool (list of modules (AO) in the appendix). The theme pool is open, which means that the offer can vary from semester to semester.			
Literature /references		Depending on the offered course			

Course	**REEMM2060...2080 - Elective Modules (F) I to III**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM2060, REEMM2070, REEMM2080 Elective Modules (F) I to III**		
	Language	English, optional German possible		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	1st or 3rd semester	Regular semester	2nd semester (3S, 4SwIS) 3rd semester (4SwoIS)
	Duration	1 semester	frequency	Annual
			compulsory / elective	compulsory
Educational methods/SWH	Methods	Lecture and follow-up course work, exercise, seminar, laboratory		
	Number SWH	4		
Work load	Presence study	64 h contact time		
	Self-study	116 h preparative and follow-up course work, individual studies, examination preparation		Σ 180 h
ECTS-points		6		
Prerequisite according study regulations				
Additional recommended requirements				
Examination procedure		In accordance with the examination procedure defined for the chosen module in the FPO.		
Learning outcomes		The students expand their practice-oriented interdisciplinary knowledge in relation to related engineering or economics, deepen their knowledge in the field of electrical engineering or computer science based on their bachelor's degree or deepen their language skills, depending on the current range of elective modules and the interests of the students.		
Content		Courses are offered according to §6 of the regulations of study programme or from the above-mentioned topic pool (list of modules (F) or (AO) in the appendix). The theme pool is open, which means that the offer can vary from semester to semester.		
Literature /references		Depending on the offered course		

Course	**REEMM2130 - Power Electronics**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM2130 - Power Electronics**		
	Language	English		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	1st or 3rd semester	Regular semester	2nd semester (3S, 4SwIS) 3rd semester (4SwoIS)
	Duration	1 semester	frequency	Annual
			compulsory / elective	compulsory
Educational methods/SWH	Methods	Lecture and post-lecture work, exercise, laboratory work		
	Number SWH	0 lectures + 2 seminar-style tuition + 1 exercise+ 1 laboratory + 0 seminar		
Work load	Presence study	64 h contact time		
	Self-study	116 h preparative and post-lecture work, individual studies, examination preparation		Σ 180 h
ECTS-points		6		
Prerequisite according study regulations		If students have already taken the subject Power Electronics in their bachelor studies according to §3 FPO, they must choose a module from the list of elective modules (F) instead.		
Additional recommended requirements				
Examination procedure		Written exam 2 h and certificate of laboratory work (Klausur 2 h und Übungsschein)		
Learning outcomes		The students can apply the fundamental Fourier analysis and corresponding complex calculus to determine the power flow of periodic signals. They are able to analyse the power flow of simple DC/DC converter topologies. The students can distinguish different power semiconductor devices. Furthermore, principles of current commutation are known. Basic PWM methods of for three phase converter topologies can be applied.		
Content		Mean values and Root mean square values of generally periodic signals, Fourier transformation with focus on fundamental extraction, power flow analysis, different power semiconductors (Diode, MOSFET, IGBT, Thyristor), current commutation process, grid commutated converters, basic DC/DC converter topologies, basic self commutated three phase converter topologies, Pulse Width Modulation for three phase converters		
Literature /references		Trzynadlowski, A. M.: Introduction to Modern Power Electronics, John Wiley & Sons, 2016. Mohan, N., Undeland, T.M., Robbins, W. P.: Power Electronics: Converters, Applications, and Design, John Wiley & Sons, 2002.		

Course	**REEMM2140 - Modelling of Physical Systems**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM2140 - Modelling of Physical Systems**		
	Language	English		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	1st or 3rd semester	Regular semester	2nd semester (3S, 4SwIS) 3rd semester (4SwoIS)
	Duration	1 semester	frequency	Annual
			compulsory / elective	compulsory
Educational methods/SWH	Methods	Lecture and post-lecture work, exercise, laboratory work		
	Number SWH	0 lectures + 2 seminar-style tuition + 0 exercise + 2 laboratory + 0 seminar		
Work load	Presence study	64 h contact time		Σ 180 h
	Self-study	116 h preparative and post-lecture work, individual studies, examination preparation		
ECTS-points		6		
Prerequisite according study regulations				
Additional recommended requirements				
Examination procedure		Written exam 2 h and certificate of laboratory work (Klausur 2 h und Übungsschein)		
Learning outcomes		The students have deepened their technical knowledge, developed analytical and creative skills for problem solving, and acquired a broad knowledge of methods for system analysis. They master the creative modeling process and are able to abstract from technical problems and to form the appropriate mathematical models. They master the programming system MATLAB / Simulink and can implement the various mathematical description forms of technical systems in simulation models, also verify them and check them for plausibility.		
Content		Application of mathematical methods and numerical methods for modeling and simulation of real systems using the MATLAB / Simulink software system: introduction to Matlab / Simulink, description of LTI systems, application of Laplace transformation, consideration of technical systems in the frequency domain, analytical modeling and simulation using different example systems		
Literature /references		Franklin, G.F.; Powell, J. D.; Emami-Naeini, A.: Feedback Control of Dynamic Systems, Pearson; 7 edition, 2017. Goodwin, G. C.; Graebe F. S.; Salgado, M. E.: Control System Design, , Pearson, 2001. Steffenhagen, B. :Kleine Formelsammlung Regelungstechnik, Carl Hanser Verlag 2010. Further literature will be announced during the course.		

Course	**REEMM2200 - Methods of Power Engineering**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM2200 - Methods of Power Engineering**		
	Language	English		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	2nd semester	Regular semester	2nd semester
	Duration	1 semester	frequency	Annual
			compulsory / elective	compulsory EE elective AE
Educational methods/SWH	Methods	Lecture and follow-up course work, exercise, laboratory		
	Number SWH	0 lectures + 2 seminar-style tuition + 1 exercise+ 1 laboratory + 0 seminar		
Work load	Presence study	64 h contact time		
	Self-study	116 h preparative and follow-up course work, individual studies, examination preparation		Σ 180 h
ECTS-points		6		
Prerequisite according study regulations				
Additional recommended requirements				
Examination procedure		Written exam 2 h and certificate of laboratory work (Klausur 2 h und Übungsschein)		
Learning outcomes		The students are able to explain and to implement practically oriented procedures to stabilize, secure and optimize electrical supply and consumer installations.		
Content		Flexible AC Transmission Systems – passive and active power filters – space vector model of electrical three phase systems – control of active power filters - high voltage DC transmission – lightning protection methods – switching operation and travelling waves – supply reliability in public mains supply		
Literature /references		Leonhard, W.: Control of Electrical Drives, Springer. Akagi, A., Watanabe, E.H., Aredes, M.: Instantaneous Power Theory and Applications to Power Conditioning. Trzynadlowski, A.M.: Modern Power Electronics. Constantinescu-Simon, L.: Handbuch Elektrische Energietechnik, Vieweg Verlag, Braunschweig, 1997. Phillipow, E.: Theoretische Elektrotechnik, Verlag Technik, Berlin, 1986. Further literature will be announced during the course.		

Course	**REEMM3600 - Quality in Automotive Industry**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM3600 - Quality in Automotive Industry**		
	Language	English, optional German possible		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	2nd semester	Regular semester	2nd semester
	Duration	1 semester	frequency	Annual
			compulsory / elective	compulsory
Educational methods/SWH	Methods	Seminar and post-seminar work, laboratory		
	Number SWH	0 lectures + 3 seminar-style tuition + 0 exercise+ 1 laboratory + 0 seminar		
Work load	Presence study	64 h seminars, laboratory, consultation		
	Self-study	116 h preparative and post-seminar work, individual studies, examination preparation		Σ 180 h
ECTS-points		6		
Prerequisite according study regulations				
Additional recommended requirements				
Examination procedure		Written exam 2 h (Klausur 2 h)		
Learning outcomes		The students are well versed in organisational and statistical methods to implement and maintain quality management systems in organisations with reference to automotive industry. Methods and concepts of quality management in automotive industry can be applied. Especially the zero defects objective will be focused. The students have the ability, to implement the requirements of the applicable quality standard in its current issue.		
Content		Quality management systems and standards, used in automotive industry. ISO 9001, ISO/TS 16949, International Automotive Task Force IATF. Process approach: quality management system; management responsibility; resource management, product realization; measurement analysis and improvement. Customers focus, corrective and preventive actions, Total Quality Management, Six Sigma, statistical methods, capability, statistical process control, measuring systems analysis, production part approval process, production process release procedure		
Literature /references		ISO/TS 16949 current revision current state QM-literature, stated in the lecture		

Course	**REEMM3800 - Energy and Environmental Management**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM3800 - Energy and Environmental Management**		
	Language	English		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	2nd semester	Regular semester	2nd semester
	Duration	1 semester	frequency	Annual
			compulsory / elective	Compulsory
Educational methods/SWH	Methods	Lecture and follow-up course work, seminar		
	Number SWH	0 lectures + 3 seminar-style tuition + 0 exercise+ 0 laboratory + 1 seminar		
Work load	Presence study	64 h contact time		
	Self-study	116 h preparative and follow-up course work, individual studies, examination preparation		Σ 180 h
ECTS-points		6		
Prerequisite according study regulations				
Additional recommended requirements				
Examination procedure		Oral examination 30 min (Mündliche Prüfung 30 min)		
Learning outcomes		The students have established understanding for the necessity of sustainable development from global to microeconomic level. They appreciate the relationships between the greenhouse effect, climate change and resulting international conventions and agreements. They are well-informed about the state and problems of the German energy transition process, emissions trade, environmental management systems and ways to increase the efficiency of energy conversions, energy saving and integration of all types of renewable energy.		
Content		Sustainability, UN Conferences for Environment and Development, implementation in the EU and Germany; global environmental problems (stratospheric ozone depletion, greenhouse effect); United Nations Framework Convention on Climate Change, Conferences of the Parties, EU climate policy, emission trade, JI and CDM; IPCC Assessment Reports, increase in efficiency during energy conversion, assessment of nuclear energy, energy management (ISO 50000), electricity stock exchange, contracting, CCS; environmental management systems, licensing procedures and Environmental Impact Assessment procedures (e.g. wind power plants)		
Literature /references		Current free publications and documents, e.g. the last IPCC Assessment Report, the EMAS III regulation or the Federal Environmental Agency Guideline for the Implementation of Energy Management Systems, are available on the ILIAS Database (e-learning system). In-depth publications will be		

	referred to during the lectures.

Course	**REEMM5000 - Master thesis with colloquium**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM5000 - Master thesis with colloquium**		
	Language	English		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	3rd semester	Regular semester	3rd semester
	Duration	1 semester	frequency	Annual
			compulsory / elective	compulsory
Educational methods/SWH	Methods			
	Number SWH			
Work load	Presence study	at least 16 h		
	Self-study	884 h		Σ 900 h
ECTS-points		30 (Master-thesis: 27 CP, Master-colloquium: 3 CP)		
Prerequisite according study regulations		see §§ 5 and 7 of the relevant examination regulations		
Additional recommended requirements				
Examination procedure		- Master's thesis (6 months, maximum of about 100 pages plus structure and appendix, §§ 24 - 26 General examination regulation) - Master-colloquium (see § 27 General examination regulation)		
Learning outcomes		Proof of the ability to meet the requirements of the master's degree stipulated in § 2 of the study regulations. In particular, the candidates demonstrate with this work that they have deepened theoretical knowledge beyond the professional knowledge acquired during the initial professional studies. By means of the special area treated in the Master thesis, they demonstrate that they are able to solve complex tasks. They can formulate new interdisciplinary solution approaches that go beyond the current knowledge. The Master's thesis shows that the students have broad analytical skills and can implement their knowledge in problem solving independently. Students apply their skills to recognize trends in the engineering sciences as well as future problems and requirements and can include them target-oriented in their activities.		
Content		Depend on the topic		
Literature /references		Depend on the topic		

In addition to the compulsory modules listed above, the curriculum for the 4-semester Master's Program Renewable Energy and E-Mobility with internship semester includes the internship semester.

Course	**REEMM4000 - Internship Semester**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM4000 - Internship Semester**		
	Language	English or German		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	3rd semester	Regular semester	3rd semester
	Duration	1 semester	frequency	Annual
			compulsory / elective	compulsory for 4SwIS
Educational methods/SWH	Methods	Seminar: 2 SWH for follow-up colloquium		
	Number SWH			
Work load	Presence study	32 h		
	Self-study	868 h		Σ 900 h
ECTS-points		30		
Prerequisite according study regulations		see study regulation, appendix 1		
Additional recommended requirements				
Examination procedure		internship activity report, ca. 20 pages (Praxisbericht, ca. 20 Seiten) presentation, ca. 30 minutes (Präsentation, ca. 30 min) (see study regulation, appendix 1)		
Learning outcomes		The students apply the knowledge acquired in their first degree of studies or in the modules taken so far in their present course of studies to solve practical problems in a company. They acquire professional skills and knowledge and get acquainted with subject-specific problems and tasks from their future fields of activity.		
Content		In accordance with the activities stipulated in the internship contract and approved by the university during the internship		
Literature /references		Depend on the topic		

In addition to the compulsory modules listed above, the curriculum for the 4-semester Master's Program Renewable Energy and E-Mobility without internship semester still includes the project work.

Course	**REEMM4100 - Project work**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM4100 - Project work**		
	Language	English		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	3rd semester	Regular semester	3rd semester
	Duration	1 semester	frequency	Annual
			compulsory / elective	compulsory for 4SwoIS
Educational methods/SWH	Methods	independent scientific work		
	Number SWH	0 lectures + 0 seminar-style tuition + 0 exercise+ 1 laboratory + 1 seminar		
Work load	Presence study	32 h		Σ 360 h
	Self-study	328 h		
ECTS-points		12		
Prerequisite according study regulations				
Additional recommended requirements				
Examination procedure		performance record, written documentation of the project work (Leistungsnachweis, schriftliche Dokumentation der Projektarbeit)		
Learning outcomes		As part of a project work, in addition to technical competence, methodological and personnel skills are acquired. The students acquire the ability to independently work on a larger project, to organize themselves and their projects, and to deal appropriately with criticism and conflicts in a team.		
Content		Topics are issued by the instructors		
Literature /references		Depends on the topic.		

Elective Modules

Course	**Solar Systems**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM1700 - Solar Systems**		
	Language	English, optional German possible		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	1st sem. in German 2nd sem. in English	Regular semester	2nd semester (3S, 4SwIS) 3rd semester (4SwoIS)
	Duration	1 semester	frequency	Annual
			compulsory / elective	elective
Educational methods/SWH	Methods	Exercise, seminar and follow-up course work, practice-oriented laboratory work		
	Number SWH	0 lectures + 2 seminar-style tuition + 1 exercise+ 1 laboratory + 0 seminar		
Work load	Presence study	64 h contact time		Σ 180 h
	Self-study	116 h preparative and follow-up course work, individual studies, examination preparation		
ECTS-points		6		
Prerequisite according study regulations				
Additional recommended requirements				
Examination procedure		Oral exam 30 min and certificate of laboratory work (Mündliche Prüfung 30 min und Übungsschein)		
Learning outcomes		The students have knowledge in the natural sciences and engineering of energy generation from solar radiation as well as the associated installation and its application. They have the ability to evaluate the individual possibilities of using the solar energy with regard to their suitability for use, taking into account the local conditions.		
Content		Solar radiation: Theoretical background, interaction between radiation and matter, greenhouse effect computations. Photovoltaics: Semiconductors, components of a PV system in island and grid-connected applications, planning and application of PV systems. Solar thermal systems: configurations, solar collectors, hot water storage, planning and applications, solar cooling, passive solar thermal systems.		
Literature /references		Larry D. Partain: Solar Cells and Their Applications, John Wiley & Sons, New York, 1995. Markvart, Tomas: Solar Electricity, John Wiley & Sons, New York, 1996. Goswami, D.Y. et. al.: Principles of Solar Engineering, Taylor & Francis 2000. Felix Peuser et. al.: Solar Thermal Systems, James & James, 2002.		

	Soteris A. Kalogirou: Solar Energy Engineering, Elsevier 2009. Further literature will be announced during the course.

Course	**Selected Topics of Control Engineering**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM2110 - Selected Topics of Control Engineering**		
	Language	English		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	1st or 3rd semester	Regular semester	2nd semester (3S, 4SwIS) 3rd semester (4SwoIS)
	Duration	1 semester	frequency	Annual
			compulsory / elective	elective
Educational methods/SWH	Methods	Lecture and post-lecture work, exercise, laboratory work		
	Number SWH	0 lectures + 1 seminar-style tuition + 2 exercise+ 1 laboratory + 0 seminar		
Work load	Presence study	64 h contact time		
	Self-study	116 h preparative and post-lecture work, individual studies, examination preparation		Σ 180 h
ECTS-points		6		
Prerequisite according study regulations				
Additional recommended requirements				
Examination procedure		Written exam 2 h and certificate of laboratory work (Klausur 2 h und Übungsschein)		
Learning outcomes		The students can actively apply the control technology for the analysis and synthesis of systems, single-loop and meshed control loops. The students have advanced knowledge of system analysis and identification as well as controller design. You can analyze and process more complex control tasks. On the basis of laboratory experiments, the engineering approach to the solution of practical tasks in the field of control engineering is promoted. The students can plan their own experiments, carry out their work, document their results and work in a team.		
Content		Concepts and presentation forms of controlled systems; Description of linear time-invariant systems in the time and frequency domain, advanced methods for process analysis and characteristic determination on lines, modeling for technical processes. PID control: Principles, modifications, controllers with two degrees of freedom, practical aspects in use (integrator windup, bumpless H / A switching, limited D component), sampling control and digital implementation, Controler design in the time and frequency domain, tuning methods, further		

	control concepts, smith predictor, introduction to nonlinear control, method of harmonic balance, laboratory experiments on the mentioned lecture contents
Literature /references	Franklin, G.F.; Powell, J. D.; Emami-Naeini, A.: Feedback Control of Dynamic Systems, Pearson; 7 edition, 2017. Goodwin, G. C.; Graebe F. S.; Salgado, M. E.: Control System Design, , Pearson, 2001. Steffenhagen, B. :Kleine Formelsammlung Regelungstechnik, Carl Hanser Verlag 2010. Further literature will be announced during the course.

Course	**Electrical Energy Conversion and Transmission**		Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM2120 –Electrical Energy Conversion and Transmission**	
	Language	English	
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility	
	Semester	1st or 3rd semester	Regular semester: 2nd semester (3S, 4SwIS) 3rd semester (4SwoIS)
	Duration	1 semester	frequency: Annual
			compulsory / elective: elective
Educational methods/SWH	Methods	seminar, laboratory work	
	Number SWH	0 lectures + 2 seminar-style tuition + 2 exercise+ 0 laboratory + 0 seminar	
Work load	Presence study	64 h contact time	Σ 180 h
	Self-study	116 h Preparation and wrap-up, independent study, documentation of the experimental work	
ECTS-points		6	
Prerequisite according study regulations		If, according to §3 FPO, students do not have a bachelor's degree in electrical engineering or in a related program, they must take this module as compulsory module. In this case, the module may not be chose again as an elective.	
Additional recommended requirements			
Examination procedure		Written exam, 2 h and certificate of laboratory work (Klausur 2 h und Übungsschein)	
Learning outcomes		The students are aware of fundamental methods to analytically describe electrical three phase systems for power transmission and electrical drive issues. They are able to practically apply the means of complex calculus to solve problems of balanced three phase systems. Basic electrical machine types are known and corresponding power balances can be calculated.	
Content		Complex calculus (single phase system), extension of the complex calculus to balanced three phase systems (per phase equivalent circuit, delta to wye transformation), transformer,	

	induction machine (squirrel cage), synchronous machine (non salient rotor, without reluctance effect)
Literature /references	Nagsarkar, T. K., Sukhija, M. S.: "Basic Electrical Engineering", Oxford University Press, ISBN – 10: 0195673921 or ISBN – 19: 978 - 0195673920 Bobrow, L. S.: "Fundamentals of Electrical Engineering", Oxford University Press, ISBN – 10: 0195105095 ISBN – 19: 978 - 0195105094 Rizzoni, G.: "Fundamentals of Electrical Engineering", (4th chapter), online PDF https://www.ece.rice.edu/~dhj/courses/elec241/col10040.pdf

Course	**German as a foreign language I**			Quality/Degree: Master Sc.	
	Course, symbol, title	**REEMM2500 - German as a foreign language I**			
	Language	German			
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility			
	Semester	2nd and 3rd semester	Regular semester	2nd semester	
	Duration	2 semester	frequency	Annual	
			compulsory / elective	Compulsory for 4.Sem.-Model	
Educational methods/SWH	Methods	Lecture, exercise and follow-up course work, seminar			
	Number SWH	1 seminar + 1 exercise per semester			
Work load	Presence study	64 h seminar, exercises, consultation			
	Self-study	86 h preparative and follow-up course work, individual studies, examination preparation			Σ 150 h
ECTS-points		6			
Prerequisite according study regulations					
Additional recommended requirements					
Examination procedure		Written exam 2 h and certificate of laboratory work (Klausur 2 h und Übungsschein)			
Learning outcomes		The language courses prepare the students for their internship semester or future professional employment in German. The students can communicate in everyday life situations, oriented towards the level of A1 of the CEFR.			
Content		1) Development of basic language knowledge such as vocabulary, grammar and pronunciation 2) Development of written and oral communication skills so that the students: - can understand and use familiar everyday expressions and very basic phrases aimed at the satisfaction of needs of a concrete type; - can introduce him/herself and others and can ask and answer questions about personal details such as where he/she lives, people he/she knows and things he/she			

	has; - can interact in a simple way provided the other person talks slowly and clearly and is prepared to help.
Literature /references	Literature will be announced during the course.

Course	**German as a foreign language II**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM2510 - German as a foreign language II**		
	Language	German		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	2nd and 3rd semester	Regular semester	2nd semester
	Duration	2 semester	frequency	Annual
			compulsory / elective	Compulsory for 4.Sem.-Model
Educational methods/SWH	Methods	Lecture, exercise and follow-up course work, seminar		
	Number SWH	1 seminar + 1 exercise per semester		
Work load	Presence study	64 h seminar, exercises, consultation		
	Self-study	86 h preparative and follow-up course work, individual studies, examination preparation		Σ 150 h
ECTS-points		6		
Prerequisite according study regulations		A1-level of the CEFR		
Additional recommended requirements				
Examination procedure		Written exam 2 h and certificate of laboratory work (Klausur 2 h und Übungsschein)		
Learning outcomes		The language courses prepare the students for their internship semester or future professional employment in German. The students can communicate in everyday life situations, oriented towards the level of A2 of the CEFR.		
Content		1) Development of basic language knowledge such as vocabulary, grammar and pronunciation 2) Development of written and oral communication skills so that the students: - can understand sentences and frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography, employment) - can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters; - can describe in simple terms aspects of his/her background, immediate environment and matters in areas of immediate need.		
Literature /references		Literature will be announced during the course.		

Course	**Wind Power Plants**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM3000 – Wind Power Plants**		
	Language	English		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	2nd semester	Regular semester	2nd semester (3S, 4SwIS) 3rd semester (4SwoIS)
	Duration	1 semester	frequency	Annual
			compulsory / elective	elective
Educational methods/SWH	Methods	Seminar, exercise, laboratory work and follow-up course work		
	Number SWH	0 lectures + 4 seminar-style tuition + 0 exercise+ 0 laboratory + 0 seminar		
Work load	Presence study	64 h contact time		
	Self-study	116 h preparative and follow-up course work, individual studies, examination preparation		Σ 180 h
ECTS-points		6		
Prerequisite according study regulations				
Additional recommended requirements				
Examination procedure		Written exam 2 h and certificate of laboratory work (Klausur 2 h und Übungsschein)		
Learning outcomes		The students are aware of the theory and practical application of wind power plants. The focus of this lecture is set on grid tied wind power plants. Hence, the students are able to understand the principle of Maximum Power Point Tracking. The understand the numerical procedure of rotor blade design and are able to determine key parameters ofthe major components of the drive train like the gear box ratio or rated power of the generator.		
Content		Dedicated fluid mechanics and air foil theory, different types of wind power plants (horizontal, vertical axis), numerical rotor blade design according to Schmitz, application of electrical drives to wind power conversion, design and speed control of the drive train		
Literature /references		Gasch, Twele: Wind Power Plants, Springer, 2. edition. Heier, S.: Grid Integration of wind energy conversion systems, John Wiley & Sons. Molly, J.-P. : Windenergie, Hüthig Jehle Rehm. Further literature will be announced during the course.		

Course	**Hydrogen Technology**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM3100 – Hydrogen Technology**		
	Language	English		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	2nd semester	Regular semester	2nd semester (3S, 4SwIS) 3rd semester (4SwoIS)
	Duration	1 semester	frequency	Annual
			compulsory / elective	elective
Educational methods/SWH	Methods	Seminar, exercise, laboratory work and follow-up course work		
	Number SWH	0 lectures + 2 seminar-style tuition + 0 exercise+ 1 laboratory + 2 seminar		
Work load	Presence study	80 h contact time		
	Self-study	100 h preparative and follow-up course work, individual studies, examination preparation		Σ 180 h
ECTS-points		6		
Prerequisite according study regulations				
Additional recommended requirements				
Examination procedure		Oral exam 30 min and certificate of laboratory work (Mündliche Prüfung 30 min und Übungsschein)		
Learning outcomes		The students have comprehensive theoretical knowledge about problems and technical solutions for the generation, storage and use of hydrogen as well as in the field of fuel cell technology. They are familiar with the most important processes and systems in terms of thermodynamic, energy-related and electrochemical description / modelling and with regard to the integration into power supply solutions and island grid systems. They are able to use these components and systems in application tasks. Participants are able to adapt and develop regenerative energy systems to market requirements by incorporating hydrogen-based processes.		
Content		Phys./chem. properties of hydrogen, hydrogen production by electrolysis and chem./biol. processes (incl. circle processes), storage and transport for stationary and mobile applications / hydrogen infrastructure; thermodynamics, theory and automation of fuel cells, hydrogen operation of gas turbines and combustion engines, safety aspects, 4 laboratory experiments corresponding to the main study subject		
Literature /references		Winter, C.-J.; Nitsch, J.: Hydrogen as an Energy Carrier / Wasserstoff als Energieträger, Springer, Berlin 1988 / 2011. James Larminie, Andrew Dicks: Fuel Cell Systems Explained, Second Edition, John Wiley 2003. Töpler, J.; Lehmann, J.: Hydrogen and Fuel Cell Technologies and Market Perspectives, Springer 2016.		

	Sterner, M.; Stadler, I.: Handbook of Energy Storage - Demand, Technologies, Integration, Springer 2018. Additional literature is given during the lectures.

Course	**Fuel Cell Systems**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM3200 – Fuel Cell Systems**		
	Language	English		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	2nd semester	Regular semester	2nd semester
	Duration	1 semester	frequency	Annual
			compulsory / elective	elective
Educational methods/SWH	Methods	Seminar style tuition, exercise, laboratory work and follow-up course work		
	Number SWH	0 lectures + 2 seminar-style tuition + 1 exercise+ 1 laboratory		
Work load	Presence study	64 h contact time		
	Self-study	116 h preparative and follow-up course work, individual studies, examination preparation		Σ 180 h
ECTS-points		6		
Prerequisite according study regulations				
Additional recommended requirements		REEMM3100 or Knowledge in the field of hydrogen technology		
Examination procedure		Oral exam 30 min and certificate of laboratory work (Mündliche Prüfung 30 min und Übungsschein)		
Learning outcomes		The students have a comprehensive knowledge to problem definitions and technical solutions with the conception and realization of fuel cell systems. They know the most important fuel cell types and their areas of application. They master the theoretical description, simulation and automation of PEM fuel cell systems as well as their integration into electrical island and supply networks and can use them in application tasks.		
Content		Theory and modelling of fuel cells, fuel cell types, design and automation of PEM fuel cell systems, FC integration in drives and energy supply solutions, laboratory tests according to focus		
Literature /references		O´Hayre, R. P.; Colella, W. G. u.a.: Fuel Cell Fundamentals, Wiley New York, 2009. Winter, C.-J.; Nitsch, J.: Hydrogen as an Energy Carrier Springer, Berlin 1988 / 2011. James Larminie, Andrew Dicks: Fuel Cell Systems Explained, Second Edition, John Wiley 2003. Töpler, J.; Lehmann, J.: Hydrogen and Fuel Cell Technologies and Market Perspectives, Springer 2016. Sterner, M.; Stadler, I.: Handbook of Energy Storage - Demand, Technologies, Integration, Springer 2018. Kurzweil, P.: Brennstoffzellentechnik, Springer Vieweg 2013		

	Additional literature is given during the lectures.

Course	**Sustainable non-fossil mobility**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM3300 – Sustainable non-fossil mobility**		
	Language	English		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	1st semester	Regular semester	2nd semester (3S, 4SwIS) 3rd semester (4SwoIS)
	Duration	1 semester	frequency	Annual
			compulsory / elective	elective
Educational methods/SWH	Methods	Seminar, exercise, laboratory work and follow-up course work		
	Number SWH	0 lectures + 2 seminar-style tuition + 2 exercise+ 0 laboratory + 0 seminar		
Work load	Presence study	64 h contact time		
	Self-study	116 h preparative and follow-up course work, individual studies, examination preparation		Σ 180 h
ECTS-points		6		
Prerequisite according study regulations				
Additional recommended requirements				
Examination procedure		Written exam 2 h and certificate of laboratory work (Klausur 2 h und Übungsschein)		
Learning outcomes		The students are able to identify, simulate and complete drive chains for mobile applications based on sustainable non-fossil mobility concepts.		
Content		Mobility, society and the environment; sustainable fuel cycles – PtF and biofuel technologies; e-mobility with its main architectures; hydrogen based mobility – drive chains, vehicles and hydrogen production; cleaner mobility with internal combustion engines and turbines; actual examples.		
Literature /references		Larminie, J.; Lowry J.: Electric Vehicle Technology Explained, 2nd Edition, John Wiley 2012, ISBN: 978-1-119-94273-3. Larminie, J.; Dicks, A.: Fuel Cell Systems Explained, 2nd Edition, John Wiley 2003, ISBN 0-471-49026-1 Töpler, J.; Lehmann, J.; Hydrogen and Fuel Cell Technologies and Market Perspectives, Springer 2016. Additional literature is given during the lectures.		

Course	**Project Seminar E-Mobility**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM3400 – Project Seminar E-Mobility**		
	Language	English		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	2nd semester	Regular semester	2nd semester (3S, 4SwIS) 3rd semester (4SwoIS)
	Duration	1 semester	frequency	Annual
			compulsory / elective	elective
Educational methods/SWH	Methods	seminar, laboratory work		
	Number SWH	0 lectures + 0 seminar-style tuition + 0 exercise+ 2 laboratory + 2 seminar		
Work load	Presence study	64 h contact time		
	Self-study	116 h Preparation and follow-up course work, independent study, documentation of the experimental work		Σ 180 h
ECTS-points		6		
Prerequisite according study regulations				
Additional recommended requirements		Fundamentals of power electronics and content of the module "Control of Electrical Drives"		
Examination procedure		Experimental work 90 h (Experimentelle Arbeit 90 h)		
Learning outcomes		The students are aware of fundamental concepts of E-Mobility and possess basic knowledge in the fields of electrical drives, electrical storage technologies and fuel cell technique. They are able to practically apply this knowledge to real vehicles.		
Content		Fundamentals of drive and carrier mechanics, fundamentals of electrical drives, fundamentals of hydrogen and storage technologies (battery and ultra capacitors), practical work on vehicle including sizing and test of single components		
Literature /references		Will be announced during lecture.		

Course	**Current subjects of renewable energy use I**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM3410 – Current subjects of renewable energy use I**		
	Language	English		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	2nd semester	Regular semester	2nd semester (3S, 4SwIS) 3rd semester (4SwoIS)
	Duration	1 semester	frequency	Annual
			compulsory / elective	elective
Educational methods/SWH	Methods	Seminar and self-study, exercises and laboratory		
	Number SWH	0 lectures + 0 seminar-style tuition + 1 exercise+ 1 laboratory + 2 seminar		
Work load	Presence study	64 h contact time		Σ 180 h
	Self-study	116 h Preparation and follow-up course work, independent study, documentation of the experimental work		
ECTS-points		6		
Prerequisite according study regulations				
Additional recommended requirements				
Examination procedure		Oral exam 30 min (Mündliche Prüfung, 30 min)		
Learning outcomes		The aim of the module is that the students know and can classify new developments in the field of renewable energy. They are able to integrate the different types of renewable energy into the solution of practical tasks and are thus optimally prepared for the practice.		
Content		In the field of renewable energy a fast development can be observed. This applies to process development, realization of new system and automation concepts and the construction of new plants in practice. The aim of the module is to make the students familiar with new developments and to prepare them optimally for their practice. For this purpose, lecturers from the industry as well as from research institutions and from abroad are in cooperation with the university and will give lectures and support laboratory work.		
Literature /references		Will be announced during lecture.		

Course	**Current subjects of renewable energy use II**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM3420 – Current subjects of renewable energy use II**		
	Language	English		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	2nd semester	Regular semester	2nd semester (3S, 4SwIS) 3rd semester (4SwoIS)
	Duration	1 semester	frequency	Annual
			compulsory / elective	elective
Educational methods/SWH	Methods	Lectures and self-study, exercises and laboratory		
	Number SWH	0 lectures + 0 seminar-style tuition + 1 exercise+ 1 laboratory + 2 seminar		
Work load	Presence study	64 h contact time		Σ 180 h
	Self-study	116 h Preparation and follow-up course work, independent study, documentation of the experimental work		
ECTS-points		6		
Prerequisite according study regulations				
Additional recommended requirements				
Examination procedure		Oral exam 30 min (Mündliche Prüfung, 30 min)		
Learning outcomes		The aim of the module is that the students know and can classify new developments in the field of renewable energy. They are able to integrate the different types of renewable energy into the solution of practical tasks and are thus optimally prepared for the practice		
Content		In the field of renewable energy a fast development can be observed. This applies to process development, realization of new system and automation concepts and the construction of new plants in practice. The aim of the module is to make the students familiar with new developments and to prepare them optimally for their practice. For this purpose, lecturers from the industry as well as from research institutions and from abroad are in cooperation with the university and will give lectures and support laboratory work.		
Literature /references		Will be announced during lecture.		

Course	**Advanced Power Electronics**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM3500 - Advanced Power Electronics**		
	Language	English		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	2nd semester	Regular semester	2nd semester (3S, 4SwIS) 3rd semester (4SwoIS)
	Duration	1 semester	frequency	Annual
			compulsory / elective	elective
Educational methods/SWH	Methods	Seminar, exercise, laboratory and work follow-up course work		
	Number SWH	0 lectures + 2 seminar-style tuition + 1 exercise+ 1 laboratory + 0 seminar		
Work load	Presence study	64 h contact time		
	Self-study	116 h preparative and post-lecture work, individual studies, examination preparation		Σ 180 h
ECTS-points		6		
Prerequisite according study regulations				
Additional recommended requirements		Fundamentals of power electronics		
Examination procedure		Written exam 2 h and certificate of laboratory work (Klausur 2 h und Übungsschein)		
Learning outcomes		The students can distinguish between different DC/DC power converter topologies as part of switched mode power supplies. They can describe in principle basic three phase converter topologies including multiphase variations. The students understand the fundamentals of pulse width modulation and can apply corresponding control algorithms to the most common three phase converter topologies.		
Content		Power converter topologies of DC/DC converters for different switched mode power supplies are presented including zero current or voltage switching control schemes. In a succeeding chapter three phase power converters are developed and corresponding multilevel topologies are introduced. As basic pulse width modulation methods for three phase applications space vector and subharmonic modulation methods are explained and finally compared with each other.		
Literature /references		Trzynadlowski, A. M.: Introduction to Modern Power Electronics, John Wiley & Sons, 2016. Mohan, N., Undeland, T.M., Robbins, W. P.: Power Electronics: Converters, Applications, and Design, John Wiley & Sons, 2002.		

Course	**Project Renewable Energy**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM3610 – Project Renewable Energy**		
	Language	English, optional German possible		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	1st or 2nd semester	Regular semester	2nd semester (3S, 4SwIS) 3rd semester (4SwoIS)
	Duration	1 semester	frequency	Annual
			compulsory / elective	elective
Educational methods/SWH	Methods	Seminaristic working form		
	Number SWH	0 lectures + 0 seminar-style tuition + 0 exercise+ 3 laboratory + 1 seminar		
Work load	Presence study	64 h contact time		
	Self-study	116 h Preparation and follow-up course work, independent study, documentation of the experimental work		Σ 180 h
ECTS-points		6		
Prerequisite according study regulations				
Additional recommended requirements				
Examination procedure		Experimental work 90 h (Experimentelle Arbeit 90 h)		
Learning outcomes		In the context of a project work, professional competence as well as competencies in methods and personnel are acquired. Students are given the opportunity to independently work on a larger project in the field of renewable energies, to organize themselves and their projects, and to deal appropriately with the team with criticism and conflicts.		
Content		Topics are given by the lecturers		
Literature /references		Literature will be announced during lecture		

Course	**Control of Electrical Drives**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM3700 - Control of Electrical Drives**		
	Language	English		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	1st or 3rd semester	Regular semester	2nd semester (3S, 4SwIS) 3rd semester (4SwoIS)
	Duration	1 semester	frequency	Annual
			compulsory / elective	elective
Educational methods/SWH	Methods	Lecture and post-lecture work, exercise, laboratory work		
	Number SWH	0 lectures + 0 seminar-style tuition + 1 exercise+ 1 laboratory + 2 seminar		
Work load	Presence study	64 h contact time		
	Self-study	116 h preparative and post-lecture work, individual studies, examination preparation		Σ 180 h
ECTS-points		6		
Prerequisite according study regulations				
Additional recommended requirements		Fundamental of electrical machines and control engineering		
Examination procedure		Written exam 2 h and certificate of laboratory work (Klausur 2 h und Übungsschein)		
Learning outcomes		The students can apply basic speed control methods to electrical drives comprising field oriented stator current control techniques. They are able to implement such control methods to different machine types such as induction and synchronous (reluctance) machines.		
Content		Space vector model of various electrical three phase machines. Efficiency optimized field oriented speed control of induction machines as well as synchronous (reluctance) machines, general (sensorless) speed control methods for three phase machines		
Literature /references		Advanced Electrical Drives: Analysis, Modeling, Control (Power Systems), Springer, 2010, De Doncker, R. Control of Electrical Drives, Springer, 2001, Leonhard, W.		

Course	**Vehicle Management Systems**			Quality/Degree: Master Sc.
	Course, symbol, title	**REEMM 5400 - Vehicle Management Systems**		
	Language	English, optional German possible		
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility		
	Semester	2nd semester	Regular semester	2nd semester (3S, 4SwIS) 3rd semester (4SwoIS)
	Duration	1 semester	frequency	Annual
			compulsory / elective	elective
Educational methods/SWH	Methods	Exercise, laboratory, seminar		
	Number SWH	0 lectures + 2 seminar-style tuition + 1 exercise+ 1 laboratory + 0 seminar		
Work load	Presence study	64 h contact time		
	Self-study	116 h Preparation and wrap-up, independent study, documentation of the experimental work		Σ 180 h
ECTS-points		6		
Prerequisite according study regulations				
Additional recommended requirements		Basics in Control Theory, Basics in MATLAB/SIMULINK		
Examination procedure		Written exam 2 h and certificate of laboratory work (Klausur 2 h und Übungsschein)		
Learning outcomes		After completion of the module, the students are able to describe the vehicle management systems function as well as to implement software algorithms using advanced control technology (optimal and non-linear controls as well as control in the state space) and their embedded implementation by means of the software engineering tool MATLAB / SIMULINK. The concept of the "vehicle" is extended to include cars, aircrafts and maritime systems of civilian and military or defense use. The students are to be enabled to abstract, conceptual, as well as signal related and system theoretical thinking in relations and gain access to transfer skills and problem solving skills.		
Content		Energy management, optimized accessories, Engine control units, On-Board-Diagnose System design using optimal, nonlinear and state space controllers for automotive dynamic control systems for: Automotive systems (Speed control, distance control, …) Integrated navigational systems for vessels (Navy-, cargo-, passenger vessels) and submarines and their weapon guidance systems as well as flight control systems for combat aircrafts, guided missiles and ballistic missiles		
Literature /references		ALKIN, Oktay. Signals and Systems. Hoboken: CRC Press, 2014, Description based upon print version of record. ISBN: 9781466598539.		

	M. ETTER, Delores. Introduction to MATLAB®. Anju Mishra. 3. edition, global edition ed. Hoboken, NJ [u.a.]: Pearson, 2015. Always learning. F. FRANKLIN, Gene, DAVID POWELL, J. y ABBAS EMAMI-NAEINI, Feedback control of dynamic systems. H. S. Sanjay. 7. ed., Global ed. ed. Boston, Mass. [u.a.]: Pearson, 2015. Always learning. Authorized adaptation from the United States edition. L. PHILLIPS, Charles. Digital control system analysis & design. H. Troy Nagle and Aranya Chakrabortty. Fourth edition, global edition ed. Boston: Pearson, 2015. Always learning. G. WEBSTER, John. Measurement, Instrumentation, and Sensors Handbook, Second Edition. Halit Eren. 2nd ed ed. Hoboken: Taylor and Francis, 2014, Description based upon print version of record. ISBN: 9781439848913. Measurement, instrumentation, and sensors handbook. John G. Webster and Halit Eren. 2. ed. ed. Boca Raton, Fla. [u.a.]: CRC Press, 2014. Includes bibliographical references and index. ISBN: Spatial, mechanical, thermal, and radiation measurement. GRAHAM C. GOODWIN, STEFAN F. GRAEBE, MARIO E. SALGADO: Control System Design. Prentice Hall. ISBN: 0-13-958653-9. KATSUHIKO OGATA: Modern Control Engineering. Prentice Hall. ISBN: 0-13-060907-2. RICHARD C. DORF, ROBERT H. BISHOP: Modern Control Systems. Prentice Hall. ISBN: 0-13-127765-0

Course	**Vehicle Simulation & Test Drive**			Quality/Degree: Master Sc.	
	Course, symbol, title	**REEMM5500 - Vehicle Simulation & Test Drive**			
	Language	English, optional German possible			
Assignment to the curriculum	Programme	Renewable Energy and E-Mobility			
	Semester	1st or 2nd semester	Regular semester	2nd semester (3S, 4SwIS) 3rd semester (4SwoIS)	
	Duration	1 semester	frequency	Annual	
			compulsory / elective	elective	
Educational methods/SWH	Methods	Laboratory, seminar			
	Number SWH	0 lectures + 2 seminar-style tuition + 0 exercise+ 2 laboratory + 0 seminar			
Work load	Presence study	64 h contact time			
	Self-study	116 h Preparation and wrap-up, independent study, documentation of the experimental work			Σ 180 h
ECTS-points		6			
Prerequisite according study regulations					

Additional recommended requirements	Automotive Engineering I/II or comparable previous knowledge
Examination procedure	Experimental work 30 h (Experimentelle Arbeit 30 h)
Learning outcomes	The student is able to model a vehicle and the surroundings (road and traffic), then perform a vehicle dynamic simulation on a computer and verify the results in experimental investigations.
Content	Presentation of different simulation programs for the interpretation of the driving behavior of motor vehicles, modeling of own developments, simulation calculation of existing test vehicles and experimental verification of the results.
Literature /references	Milliken, W., Milliken, D. L.: Race Car Vehicle Dynamics, SAE, Inc. ISBN 1-56091-526-9. Gillespie, Th.D.: Fundamentals of Vehicle Dynamics. Warrendale: SAE, Inc. 1992 Fenton, J. Handbook of vehicle design analysis,1996, ISBN 0 85298 963 6 Further literature will be announced during the course

Course	**Human Resources Management**			Quality/Degree: Master Sc.
	Course, symbol, title	**WMSSDM3000 - Human Resources Management**		
	Language	English		
Assignment to the curriculum	Programme	Simulation and System Design Renewable Energy and E-Mobility		
	Semester	1st or 3rd semester	Regular semester	2nd semester (3S, 4SwIS) 3rd semester (4SwoIS)
	Duration	1 semester	frequency	Annual
			compulsory / elective	elective
Educational methods/SWH	Methods	Seminar-style lecture (Seminaristischer Unterricht)		
	Number SWH	0 lectures + 4 seminar-style tuition + 0 exercise + 0 laboratory + 0 seminar		
Work load	Presence study	64 h contact time		Σ 180 h
	Self-study	116 h		
ECTS-points		6		
Prerequisite according study regulations				
Additional recommended requirements				
Examination procedure		Case study incl. presentation 116 hours (Fallstudie 116 Stunden inklusive Präsentation)		
Learning outcomes		- Theoretical and empirical understanding of organizational and cultural conditions for HRM in a globalized world and esp. challenges refer to demographic change.		

	- Be able to provide and coordinate HRM activities to solve all tasks performed in an organization with respect to its goals and based on scientific methods and tools.
Content	- Landscape/ HRM concepts/ Distinction IHRM - Organizational, cultural and societal context - Diversity Management - Intercultural training - Strategic HRM
Literature /references	Bohlander, G.W.; Snell, S.A. (2012): Principles of Human Resource Management. 16th edition. South Western Learning. Bourdieu, P. (1986): Ökonomisches Kapital, kulturelles Kapital, soziales Kapital. In: Soziale Ungleichheiten (Soziale Welt, Sonderheft 2), edited by Reinhard Kreckel. Goettingen: Otto Schartz & Co.. 1983. pp. 183 -98. The article appears here for the first time in English. Translated by Richard Nice. Hofstede, G. (2001), Culture's Consequence, Thousand Oaks, CA: Sage Publications. Hofstede, G. (2002), "Images of Europe: Past, Present and Future", in: Warner M., Joynt P. (eds), Managing Across Cultures. Padstow: Thompson. Rothlauf, J. (2014): A global view on intercultural management. Oldenbourg

Course	**International Accounting**			Quality/Degree: Master Sc.	
	Course, symbol, title	**SSDM3500 - International Accounting**			
	Language	English			
Assignment to the curriculum	Programme	Simulation and System Design Renewable Energy and E-Mobility			
	Semester	1st or 3rd semester	Regular semester	2nd semester (3S, 4SwIS) 3rd semester (4SwoIS)	
	Duration	1 semester	frequency	Annual	
			compulsory / elective	elective	
Educational methods/SWH	Methods	independent scientific work			
	Number SWH	2 lectures + 0 seminar-style tuition + 2 exercise + 0 laboratory + 0 seminar			
Work load	Presence study	64 h contact time			
	Self-study	116 h			Σ 180 h
ECTS-points		6			
Prerequisite according study regulations					
Additional recommended requirements		basic knowledge of accounting practices			
Examination procedure		written exam 120 minutes (Klausur 120 Minuten)			

Learning outcomes	The students get a comprehensive introduction to financial reporting according the International Financial Reporting Standards (IFRS). They learn how the standards are used in the preparation of financial statements. The students understand the underlying concepts of Accounting using IFRS. They are able to solve easy and moderately difficult accounting problems.
Content	• regulatory framework, • IASB conceptual framework, • financial reporting in practice, e.g. accounting of property, plant and equipment, intangible assets, inventories, long-term production orders, financial instruments, provisions, deferred items • additional instruments of international financial reporting, e.g. cash flow statement, segment reporting
Literature /references	Harrison, Walter T., Horngreen Charles T., Thomas, C. William, Themin Suwardy: Financial Accounting. International Financial Reporting Standards, Pearson, 9. ed., 2013 Kolitz, David: Financial Accounting. A Concepts-Based Introduction, Routledge, 2016 Melville, Alan: International Financial Reporting: A Practical Guide, Pearson, 5. ed., 2015 Weygandt, Jerry J., Kimmel, Paul D., Kieso, Donald E.: Financial Accounting. IFRS Edition, Wiley, 3 ed., 2015

Explanation:

3S = 3-semester variant (3-semestrige Variante)
4SwIS = 4-semester variant with internship semester (4-semestrige Variante mit Praxissemester)
4SwoIS = 4-semester variant without internship semester (4-semestrige Variante ohne Praxissemester)

Curricula

Curriculum for the 3-Semester-Model

This study plan is valid for matriculation in the summer semester. If the matriculation is in the winter semester, the first and second semesters must be exchanged.

Course	Type	1.	2.	3.	SWH	ECTS
Mathematical-scientific and technical bases					**8**	**12**
REEMM1300 - System Theory	CM		4+0		4	6
REEMM2140 – Modelling of Physical Systems	CM	2+2			4	6
Specialized technical bases of renewable energy					**12**	**18**
REEMM1400 - Renewable Energy Systems	CM	4+0			4	6
REEMM2130 - Power Electronics [A]	CM	3+1			4	6
REEMM2200 - Methods of Power Engineering	CM		3+1		4	6
Application-oriented profiling, elective modules					**16**	**24**
REEMM2010 - Elective Module (AO) I	EM	4			4	6
REEMM2020 - Elective Module (AO) II	EM		4		4	6
REEMM2030 - Elective Module (AO) III	EM		4		4	6
REEMM2040 - Elective Module (AO) IV [B]	EM		4		4	6
Interdisciplinary qualifications (1 from 2)					**4**	**6**
REEMM3600 - Quality in Automotive Industry	EM *)	3+1			4	6
REEMM3800 - Energy and Environmental Management	EM *)		3+1		4	6
Master-Thesis with colloquium	CM			6M	**6M**	**30**
Total		**20**	**20**	**6M**	**40 + 6M**	**90**

Curriculum for the 4-Semester-Model with Internship Semester

Course	Type	1.	2.	3.	4	SWH	ECTS
Mathematical-scientific and technical bases						**8**	**12**
REEMM1300 - System Theory	CM		4+0			4	6
REEMM2140 - Modelling of Physical Systems	CM	2+2				4	6
Specialized technical bases of renewable energy						**12**	**18**
REEMM1400 - Renewable Energy Systems	CM	4+0				4	6
REEMM2130 - Power Electronics [A]	CM	3+1				4	6
REEMM2200 - Methods of Power Engineering	CM		3+1			4	6
Application-oriented profiling, elective modules						**16**	**24**
REEMM2010 - Elective Module (AO) I	EM	4				4	6
REEMM2020 - Elective Module (AO) II	EM		4			4	6
REEMM2030 - Elective Module (AO) III	EM		4			4	6
REEMM2040 - Elective Module (AO) IV [B]	EM		4			4	6
Interdisciplinary qualifications (1 from 2)						**4**	**6**
REEMM3600 - Quality in Automotive Industry	EM *)	3+1				4	6
REEMM3800 - Energy and Environmental Management	EM *)		3+1			4	6
Internship semester	CM			21W		**21W**	**30**
Master-Thesis with colloquium	CM				6M	**6M**	**30**
Total		**20**	**20**	**5M**	**6M**	**40+11M**	**120**

Curriculum for the 4-Semester-Model without Internship Semester

Course	Type	1.	2.	3.	4	SWH	ECTS
Mathematical-scientific and technical bases						**8**	**12**
REEMM1300 - System Theory	CM		4+0			4	6
REEMM2140 - Modelling of Physical Systems	CM	2+2				4	6
Specialized technical bases of renewable energy						**12**	**18**
REEMM1400 - Renewable Energy Systems	CM	4+0				4	6
REEMM2130 - Power Electronics [A]	CM	3+1				4	6
REEMM2200 - Methods of Power Engineering	CM		3+1			4	6
Application-oriented profiling, elective modules						**28**	**42**
REEMM2010 - Elective Module (AO) I	EM	4				4	6
REEMM2020 - Elective Module (AO) II	EM		4			4	6
REEMM2030 - Elective Module (AO) III	EM		4			4	6
REEMM2040 - Elective Module (AO) IV [B]	EM		4			4	6
REEMM2060- Elective Module (F) I	EM			4		4	6
REEMM2070 - Elective Module (F) II	EM			4		4	6
REEMM2080 - Elective Module (F) III	EM			4		4	6
Interdisciplinary qualifications (1 from 2)						**4**	**6**
REEMM3600 - Quality in Automotive Industry	EM *)	3+1				4	6
REEMM3800 - Energy and Environmental Management	EM *)		3+1			4	6
REEMM4100 Project work	CM			360h		**360h**	**12**
Master-Thesis with colloquium	CM				6M	**6M**	**30**
Total		**20**	**20**	**12 +360h**	**6M**	**52+6M +360h**	**120**

Open list of elective modules (AO) (according to § 6 of the regulations of study programme):

- Hydrogen Technology
- Solar Systems
- Wind Power Plants
- Advanced Power Electronics
- Vehicle Management Systems
- Control of electrical drives
- Project Seminar E-Mobility
- Current Topics of renewable energy use I and II
- Project Renewable Energy
- Sustainable non-fossil mobility
- Vehicle Simulation & Test Drive
- Fuel Cell Systems

Open list of elective modules (F) (according to §6 of the regulations of study programme):

- Selected Topics of Control Engineering
- International Accounting
- German as a foreign Language I
- Electrical Energy Conversion and Transmission
- Human Resources Management
- German as a foreign Language II
- This list also contains all modules of the list AO.
- It is also possible to choose one of the modules "Quality in Automotive Industry" or "Energy and Environmental Management" if it was not chosen in the category interdisciplinary qualifications.

Explanations:

CM = Compulsory module, Pflichtmodul

EM = Elective module, Wahlpflichtmodul

[A] = If students have already taken the subject Power Electronics according to §3 FPO, they must choose a module from the list of elective modules (F) or (AO) instead.

[B] = If, according to §3 FPO, students do not have a bachelor's degree in electrical engineering or a related program, they must take the module REMMM 2120 "Electrical Energy Conversion and Transmission" instead. In this case, the module may not be chose again as an elective.

*) = One of these two modules must be selected; on request, additional modules from the area of "Interdisciplinary qualification" from other Master's degree courses in the Department of Electrical Engineering and Computer Science can also be selected.

6M = 6 months

360h = 360 hours

x + y = Lecture-/ seminar-style tuition- / exercise hours + laboratory-/seminar hours

The subdivision of the semester week hours (SWH) during lecture-/ seminar-style tuition- / exercise hours + laboratory-/seminar hours is a proposal, which can be varied by the instructor in his / her own direction.

Use of the modules in other programs

Module	Elective/ Compulsory in REEMM	Use in other Programs	Elective/ Compulsory in the other program	SWH	ECTS
REEMM1300 - System Theory	CM	-		**4**	**6**
REEMM1400 - Renewable Energy Systems	CM	-		**4**	**6**
REEMM1700 - Solar Systems	EM	-		**4**	**6**
REEMM2110 - Selected Topics of control engineering	EM	-		**4**	**6**
REEMM2120 - Electrical Energy Transmission	EM	-		**4**	**6**
REEMM2130 - Power Electronics	EM	-		**4**	**6**
REEMM2140 - Modelling of Physical Systems	EM	-		**4**	**6**
REEMM2200 - Methods of Power Engineering	CM	ETM-EE ETM-AE	CM EM	**4**	**6**
REEMM2500 - German as a foreign Language	EM			**4**	**6**
REEMM2510 - German as a foreign Language II	EM			**4**	**6**
REEMM3000 - Wind Power Plants	EM	ETM	EM	**4**	**6**
REEMM3100 - Hydrogen Technology	EM	ETM	EM	**5**	**6**
REEMM3200 - Fuel Cell Systems	EM	ETM	EM	**4**	**6**
REEMM3300 - Sustainable non-fossil mobility	EM	ETM	EM	**4**	**6**
REEMM3400 - Project Seminar E-Mobility	EM	ETM	EM	**4**	**6**
REEMM3410 - Current subjects of renewable energy use I	EM	ETM	EM	**4**	**6**
REEMM3420 - Current subjects of renewable energy use II	EM	ETM	EM	**4**	**6**
REEMM3500 - Advanced Power Electronics	EM	ETM	EM	**4**	**6**
REEMM3600 - Quality in Automotive Industry	EM	SSDM	EM	**4**	**6**
REEMM3700 - Control of Electrical Drives	EM	ETM	EM	**4**	**6**
REEMM3800 - Energy and Environmental Management	EM	ETM	EM	**4**	**6**

REEMM5400 - Vehicle Management Systems	EM	SSD ETM	CM EM	**4**	**6**
REEMM5500 - Vehicle Simulation and Test Drive	EM	SSDM, ETM	EM	**4**	**6**
SSDM3500 - International Accounting	EM	SSDM	CM	**4**	**6**
WMSSDM3000 - Human Resources Management	EM	SSDM	EM	**4**	**6**

Explanations:

ETM: Master Program Electrical Engineering
SSDM: Master Program Simulation and System Design