Module level Master	Credit points 6	Language English	Return annual
Module designation Construction and Design of the Nacelle-Systems			
Course(s) Nacelle-Systems Design			
Code	**Subtitle**		
Person responsible for the module	Prof. Dr. rer. nat. Clemens Hoffmann		
Lecturer	Dr.-Ing. Jan Wenske		
Workload	180 h (20 h online presentation, 40 h private study, 120 h exercise)		
Relation to curriculum	Specialist studies, Electrical Systems Technology, elective		
Type of teaching, contact hours	online script, lecture video, digital communication		
Requirements according to examination regulations	None		
Recommended prerequisites Modules Mathematics, Solid Mechanics, Electrical Engineering, Design of Mechanical and Electrical Components			
Module objective / intended learning outcomes The students know the basic structure and design methods for the gondola system of modern horizontal axes wind turbines. Herein the nacelle system comprises besides the classic drive train with main shaft, bearing, gear, clutch, brake and generator also the hub including the blade journal bearings and pitch systems as well as other auxiliary systems such as the azimuth drive, cooling and lubrication systems. The purely electrical subsystems like main inverter, system transformers, switch gear etc. are presented, but not in depth with regard to their detailed design. The students know the common variants and functions of electrical nacelle systems. The main mechanical components including the nacelle structures can be calculated and dimensioned with respect to given turbine performance requirements, extreme and fatigue loads from the rotor side. Fundamental advantages and disadvantages of drive train concepts can be identified and discussed professionally by the students. Based on the knowledge provided in this module, they should be able to develop their own concepts and to create more detailed drive train constructions or at least to write detailed specification for nacelle/WT drive train components.			
Content Introduction of extreme and operational fatigue loads for WT drive trains / design criteria Basic principles and diversification of current WT drive trains (introduction of the main variants) Calculation and design principle of WT shafts, coupling, suspension and nacelle supporting structure Basic knowledge and design principles of gear transmission for WT (geared & hybrid drives) Design of the auxiliary nacelle systems (cooling, lubrication, brakes, hydraulic systems, E-Drives) Basic design principle for WT generators (IG, DFIG, EESG, PMSG) in geared and direct drive variants / comparison of characteristics due to design parameter Variations and functions of electrical Nacelle systems (Converter, transformer, switch gear, etc.) Introduction of 1-6 degree of freedom drive train system dynamics / comparison of mechanical drive train characteristics drive train modeling for digital system simulation and controller design.			
Study and examination requirements	Oral examination (20min) and Presentation (15min). The		

and forms of examination	examination results proceed with a weight of 1:1 in the final grade.
Media employed	online script, teaching video

Reading list

Hau, E.: Wind Turbines: Fundamentals, Technologies, Application, Economics. Springer-Verlag, Berlin Heidelberg, 3rd ed. 2012

I.N. Bronshtein, K.A. Semendyayev, G. Musiol, H. Muehlig, H. Mühlig: Handbook of Mathematics,Springer-verlag, Berlin Heidelberg New York, 4rd. ed. 2004

Karl-Heinrich Grote, Erik K. Antonsson: Springer Handbook of Mechanical Engineering, Springer-Verlag, Berlin Heidelberg, 2009