Specification for the book of courses

Study program	Electrical Engineering and Computer Science		
Module	Common		
Type and level of studies	Doctoral studies		
The name of the course	Electrical Machines and Power Converters for Renewable Energy Sources		
Lecturer (for lectures)	Petronijević P. Milutin, Mitrović N. Nebojša		
Lecturer/associate (for exercises)			
Lecturer/associate (for OFE)			
Number of ECTS	10	**Course status (obligatory/elective)**	Elective

Prerequisites	None
Course objectives	The study of machines and converters specificities for application in the field of renewable energy. The study of advanced control techniques and analysis of the power quality effects on the operation of the power converter. Analysis of the distribution network effects on the power electronic converter operation. Micro-grid architecture, operation and control.
Course outcomes	At the end of the course, students will be qualified for independent analysis of machines and converters for applications in distributed power sources. Competence to solve the actual problems in selection of machine types and power converters topologies and control methods.
Course outline	
Theoretical teaching	Topologies of grid-side converters. Wind turbines with fixed and variable speed operation - DFIG, back-to-back power converters. Photovoltaic sources. DC/DC voltage converters. Energy storages. Optimization of power flow. Stationary and dynamic modes of operation. Grid synchronization and power flow control. Standalone operation. Coordinated control of converters in micro-grid. Power quality effects on the grid converters operation: voltage dips, surges, short circuits. Micro-grid networks integration.
Practical teaching (exercises, OFE, study and research	The part of teaching includes individual study and research work in the course area. It involves active studying of the basic scientific sources, computer simulations, and performing of experiment in laboratory.
Textbooks/references	
1	Fuch, E.F.; Masoum, M.A.S."Power Conversion of Renewable Energy Systems," Springer, 2011
2	Remus Teodorescu, Marco Liserre, Pedro Rodríguez, "Grid Converters for Photovoltaic and Wind Power Systems," Wiley, 2011.
3	Gonzalo Abad, Jesus Lopez, Miguel Rodriguez, Luis Marroyo, Grzegorz Iwanski, "Doubly Fed Induction Machine: Modeling and Control for Wind Energy Generation (IEEE Press Series on Power Engineering)", IEEE, 2011.
4	Ruan, X., Wang, X., Pan, D., Yang, D., Li, W., Bao, C, "Control Techniques for LCL-Type Grid-Connected Inverters", Springer, 2017.
5	Qing-Chang Zhong T. Hornik, "Control of power inverters in renewable energy and smart grid integration", Wiley, 2013.

Number of classes of active education per week during semester/trimester/year

Lectures	**Exercises**	**OFE**	**Study and research work**	**Other classes**
3	0	0	0	0

Teaching methods	Teaching includes lectures and consultations, as well as individual work with the students during study and students research work.

Grade (maximum number of points 100)

Pre-exam duties	**Points**	**Final exam**	**Points**
Activity during lectures		**Written exam**	
Exercises		**Oral exam**	50
Colloquia			
Projects	50		