

Course code																																	
Type and description	EC – Elective Course in Discipline: Automation, Electronic and Electrical Engineering																																
ECTS credit	1																																
Course name	Modern renewable electrical power systems																																
Course name in Polish	Nowoczesne systemy elektroenergetyczne ze źródłami odnawialnymi																																
Language of instruction	English																																
Course level	8 PRK																																
Course coordinator	dr hab. inż. Irena Wasiak, prof. uczelni																																
Course instructors	dr inż. Tomasz Siewierski																																
Delivery methods and course duration	<table border="1"> <thead> <tr> <th></th> <th>Lecture</th> <th>Tutorials</th> <th>Laboratory</th> <th>Project</th> <th>Seminar</th> <th>Other</th> <th>Total of teaching hours during semester</th> </tr> </thead> <tbody> <tr> <td>Contact hours</td> <td>0</td> <td>0</td> <td>0</td> <td>5</td> <td>0</td> <td>0</td> <td>5</td> </tr> <tr> <td>E-learning</td> <td>no</td> <td>no</td> <td>no</td> <td>no</td> <td>no</td> <td>no</td> <td>no</td> </tr> <tr> <td>Assessment criteria (weightage)</td> <td>0</td> <td>0</td> <td>0</td> <td>100%</td> <td>0</td> <td>0</td> <td>100%</td> </tr> </tbody> </table>		Lecture	Tutorials	Laboratory	Project	Seminar	Other	Total of teaching hours during semester	Contact hours	0	0	0	5	0	0	5	E-learning	no	no	no	no	no	no	no	Assessment criteria (weightage)	0	0	0	100%	0	0	100%
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Course objective	Expand PhD students' knowledge about development trends of modern renewable electrical power systems, implementation of emerging renewable generation technologies, about challenges concerning integration, control, economics and management of the network operation with high penetration of RES.																																
Learning outcomes	<p>A PhD student knows and understands:</p> <ol style="list-style-type: none"> 1. Foremost development trends of modern renewable energy systems and their importance for the electric power system - W1 effects (P8S_EG) <p>A PhD student is capable of:</p> <ol style="list-style-type: none"> 2. Identify and solve problems related to the operation of power systems with the use of renewable sources, formulate research tasks, adapt research methods and techniques to the tasks being solved, and conduct critical analysis and evaluation of scientific research results - the U1 effect (P8S_UW) 3. Plan and implement individual and team research or creative projects - effect U3 (P8S_UO) <p>The PhD student is prepared to:</p> <ol style="list-style-type: none"> 4. Critical assessment of achievements within a given discipline - effects of K1 (P8S_KK) 5. Recognizing the importance of knowledge in solving cognitive and practical problems - K1 effects (P8S_KK) 																																
Assessment methods	<p>Methods for verifying learning outcomes</p> <p>Effects 1-5 - evaluation of the submitted project report.</p> <p>The final grade is calculated as a weighted average of the following components:</p> <p>Evaluation of the submitted project in writing – 80%</p> <p>Assessment of project presentation – 20%</p>																																

Prerequisites	N/A
Course content with delivery methods	<p>PROJECT:</p> <p>Implementation of a project including handling of engineering and economic problems outlining the trends of modern renewable energy system development, with particular focus on the future operation of the modern electrical power system. The scope of the project concerns a selected aspects of modern energy system operation, in particular:</p> <ol style="list-style-type: none"> 1. Influence of the trends of modern renewable energy systems development on the operation of the electrical power system, 2. Implementation of new renewable generation technologies and environmentally friendly power system transmission distribution and energy efficiency technologies, 3. Integration of new electricity generation and storage technologies, flexible loads, planning and controlling the operation of power systems and networks with the dominant role of renewable sources.
Basic reference materials	<ol style="list-style-type: none"> 1. Zbigniew Lubośny, „Farmy wiatrowe w systemie elektroenergetycznym”, Wydawnictwo Naukowe PWN, WNT, Warszawa, 2020. 2. Maciej Sibiński, Katarzyna Znajdek, „Przyrządy i instalacje fotowoltaiczne”, Wydawnictwo Naukowe PWN, Warszawa, 2020. 3. Dorota Chwieduk, „Energetyka odnawialna w budownictwie. Magazynowanie energii”, Wydawnictwo Naukowe PWN, Warszawa, 2018. 4. Hadi Saadat, „Power Systems Analysis”, McGraw-Hill, 2nd Revised edition, 2004. 5. Ali Keyhani, „Design of Smart Power Grid Renewable Energy Systems”, John Wiley & Sons, 3rd Edition, 2019.
Other reference materials	<ol style="list-style-type: none"> 1. Tadeusz Chmielniak, „Technologie energetyczne”, Wydawnictwo Naukowe PWN, Warszawa, 2020. 2. Ryszard Pawelek, Irena Wasiak, „Jakość zasilania w sieciach z generacją rozproszoną”, Wydawnictwo Naukowe PWN, Warszawa, 2015. 3. Zbigniew Lubośny, „Elektroenergetyczna automatyka zabezpieczeniowa farm wiatrowych”, Wydawnictwo Naukowe PWN, Warszawa, 2020. 4. Paul Gipe, „Wind Power, Revised Edition: Renewable Energy for Home, Farm, and Business”, Chelsea Green Publishing; Revised and updated second edition, 2004. 5. Daniel S. Kirschen, Goran Strbac, „Fundamentals of Power System Economics”, John Wiley & Sons, 2004
Average student workload outside classroom	25h
Comments	No comments
Last update	July 2020