

DESCRIPTION OF THE COURSES

- Course code: **ELR2213**
- Course title: **Automatic control and relay protection of dispersed energy sources**
- Language of the lecturer: **polish**

<i>Course form</i>	<i>Lecture</i>	<i>Classes</i>	<i>Laboratory</i>	<i>Project</i>	<i>Seminar</i>
<i>Number of hours/week*</i>	1		1		1
<i>Number of hours/semester*</i>	15		15		15
<i>Form of the course completion</i>	<i>exam.</i>		<i>pass</i>		<i>pass</i>
<i>ECTS credits</i>	2		1		1
<i>Total Student's Workload</i>	60		30		30

- Level of the course (basic/advanced): **basic**

Prerequisites: **Electrical Power System 1, Disturbances in Industrial Devices and Distribution Networks, Power system protection**

- Name, first name and degree of the lecturer/supervisor: **Wilhelm Rojewski, Ph.D., Eugeniusz Rosolowski, Professor.**
- Names, first names and degrees of the team's members: **Marcin Habrych, Ph.D., Grzegorz Wiśniewski, Ph.D.**
- Year:....I/II stage..... Semester:.....**2**.....
- Type of the course (obligatory/optional): **obligatory**
- Aims of the course (effects of the course): **to make students familiar with problems related to automatic control and relay protection of dispersed and non-conventional energy sources and systems.**
- Form of the teaching (traditional/e-learning): **traditional**
- Course description:

Main characteristics of distribution networks with dispersed energy sources will be presented. Technical impact of dispersed generators on power load flow, short-circuit currents, voltage control, and protection of distribution network will be discussed. Autonomous operation of small-scale dispersed generators and microgrids with dispersed energy sources will also be discussed.

- Lecture:

<i>Particular lectures contents</i>	<i>Number of hours</i>
1. Main characteristics of distribution network with dispersed generation	1 h
2. Main characteristics of dispersed generation and its technical	1 h

impact on operation of distribution network	
3. Protection of dispersed generation with synchronous generators	2 h
4. Protection of dispersed generation with induction generators	2 h
5. Network protection in distribution systems with dispersed generation	2 h
6. Automatic voltage control in distribution network with dispersed generation	2 h
7. Compensation of reactive power in distribution network with dispersed generation	2 h
8. Autonomous operation of small-scale energy sources	1 h
9. Relay protection of microgrids with dispersed energy sources	2 h

- Classes – the contents:
- Seminars – the contents:

Every student gets individual work to carry out. The work consists on elaboration of protection of dispersed generator and distribution system operated in a system pointed out by lecturer. The elaborated conception is presented by student and discussed on forum of students group.

- Laboratory – the contents
 1. Main protection of synchronous generator
 2. Loss of mains protection
 3. Automatic voltage regulation of synchronous generator
 4. Synchronizing and connecting of generator to the network
 5. Under-load tap-changing transformer control system
 6. Automatic control of capacitor bank
- Project – the contents:
- Basic literature:
 1. Kacejko P.: Generacja rozproszona w systemie elektroenergetycznym. Wydawnictwo Uczelniane. Politechnika Lubelska 2004.
 2. Jenkins N., Allan R., Crossley P., Kirschen D., Strbac G.: Embedded Generation. Power & Energy 2000.
 3. Lubośny Z.: Elektrownie wiatrowe w systemie elektroenergetycznym. WNT warszawa 2006.
 4. Synal B., Rojewski W., Dzierżanowski W.: Elektroenergetyczna automatyka zabezpieczeniowa. Podstawy. Oficyna Wydawnicza PWr., Wrocław 2003.
 5. Ungrad H., Winkler W., Wiszniewski A.: Protection Techniques in Electrical Energy Systems, CRC Press, 1995.
- Additional literature:
 1. www.ptpiree.pl; www.cire.pl; www.pse.pl, www.kape.gov.pl, www.elektrownie-wiatrowe.org.pl, www.mew.pl, www.mikrosieci.pl
- Conditions of the course acceptance/credition: Pass of laboratory and seminar and passing of examination

* - depending on a system of studies

