

DESCRIPTION OF THE COURSES

- Course code: **ELR1103**
- Course title: **Disturbances in industrial devices and distribution networks**
- Language of the lecturer:

<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>	2	1	1		
<i>Number of hours/semester*</i>	30	15	15		
<i>Form of the course completion</i>	pass	completion	completion		
<i>ECTS credits</i>	3	1	1		
<i>Total Student's Workload</i>	90	30	30		

- Level of the course (basic/advanced): **basic**
- Prerequisites: **Theory of Electrical Circuits, High Voltage Engineering, Electrical Power Systems**
- Name, first name and degree of the lecturer/supervisor: **Janusz Fleszyński, prof. dr hab. inż., Wilhelm Rojewski, dr inż.**
Names, first names and degrees of the team's members: **Janina Pospieszna, dr hab. inż., Maciej Jaroszewski, dr inż., Krzysztof Wieczorek, dr inż.**
- Year:.....III/I degree..... Semester:.....6.....
- Type of the course (obligatory/optional): **obligatory**
- Aims of the course (effects of the course): **understanding of occurrence of disturbances in electric devices and networks and knowing the ways to protect against them.**
- Form of the teaching (traditional/e-learning): **traditional**
- Course description:
Kinds and characteristics of electromagnetic disturbances in power distribution networks and industrial devices. Lightning electromagnetic threats. Overvoltage protection of installations and devices in buildings. Electromagnetic field shielding. Electrostatic discharges. Voltage disturbances in aspects of power quality. The reasons and consequences of short-circuits. Definitions of short-circuit values and parameters. Representation of power system components in equivalent circuit diagrams. Calculation of short-circuit currents and voltages on the terminals of protective devices and loads. The methods of mitigation of short-circuits impact on sensitive loads.

- Lecture:

<i>Particular lectures contents</i>	<i>Number of hours</i>
1. Introduction, kinds and characteristics of electromagnetic disturbances.	2h
2. Lightning electromagnetic threats – phenomena and parameters.	2 h
3. Overvoltage protection of installations and devices in buildings. Concept	2 h

of lightning protection zones.	
4. Nonlinear protective components (gas tubes, varistors, diodes). Hybrid protective systems.	2 h
5. Electromagnetic field shielding, material progress in shielding techniques.	2 h
6. Electrostatic discharges - parameters, threats, remedial measures.	2 h
7. Voltage disturbances in aspects of power quality.	2 h
8. Power quality disturbances mitigation techniques.	1 h
9. The types and reasons and consequences of faults.	2 h
10. The sources of short-circuit currents in the power system	2 h
11. Equivalent diagrams for 0-1-2 components	2 h
12. The currents and voltages on the terminals of protective devices and loads during balanced short-circuits.	1 h
13. The currents and voltages on the terminals of protective devices and loads during unbalanced line-to-line short-circuits.	2 h
14. The currents and voltages on the terminals of protective devices and loads during line-to-earth short-circuits in networks with grounded neutral.	2 h
15. The currents and voltages on the terminals of protective devices and loads during line-to-earth short-circuits in networks with not-grounded neutral	2 h
16. The methods of mitigation of short-circuits impact on sensitive loads.	2 h

- Classes – the contents:

Calculation of currents and voltages in the place of fault and on the terminals of protective devices and loads during balanced and unbalanced short-circuits. Discussion of the results of calculation in respect of safe and uninterrupted supplying of loads. Employment of the short-circuit calculation to assessment of conditions of protective devices operation.

- Seminars – the contents:

- Laboratory – the contents:

Generation and measurements of lightning impulse voltages. Testing of high voltage arresters. Testing of static and dynamics characteristics of arresters and gas tubes.

- Project – the contents:

- Basic literature:

1. Sowa A., Kompleksowa ochrona odgromowa i przepięciowa, Biblioteka COSiW SEP, Warszawa 2005
2. Flisowski Z., Technika wysokich napięć, WNT Warszawa 2000
3. Kacejko P., Machowski J., Zwarcia w systemach elektroenergetycznych. WNT Warszawa 2002.
4. Gonen T.: Modern power system analysis, 1988.

- Additional literature:

1. Haase P., Overvoltage protection of low voltage systems, The Institution of Electrical Engineers, London 2000
 2. Więckowski T., Badania kompatybilności elektromagnetycznej urządzeń elektrycznych i elektronicznych, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2001.
 3. PN-EN 60909-0 Prądy zwarciove w sieciach trójfazowych prądu przemiennego- Część 0: Obliczanie prądów. Sierpień 2002.
- Conditions of the course acceptance/creditation: Completion of laboratory tasks and classes and pass of examination

* - depending on a system of studies