

## DESCRIPTION OF THE COURSES

- Course code: **ELR2210**
- Course title: **POWER SYSTEM PROTECTION**
- Language of the lecturer: **english**

<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>	<b>2</b>		<b>2</b>		
<i>Number of hours/semester*</i>	<b>30</b>		<b>30</b>		
<i>Form of the course completion</i>	<b>Exam</b>		<b>Completion of Lab</b>		
<i>ECTS credits</i>	<b>4</b>		<b>2</b>		
<i>Total Student's Workload</i>	<b>120</b>		<b>60</b>		

- Level of the course (basic/advanced): **basic**
- Prerequisites: **Grounded knowledge on electricity and passed grade of: Electrical measurement, Electrical machines, Electrical devices, Electrical power systems**
- Name, first name and degree of the lecturer/supervisor: **Prof. Bogdan Miedziński Ph.D., D.Sc.**
- Names, first names and degrees of the team's members:  
**Mieczysław Zielichowski, Ph.D., D.Sc.**  
**Henryk Belka, Ph.D.**  
**Witold Dzierżanowski, Ph.D.**  
**Wilhelm Rojewski, Ph.D.**  
**Grzegorz Wiśniewski, Ph.D.**
- Year:.....**I./ II stage**..... Semester:.....**II**.....
- Type of the course (obligatory/optional): **obligatory**
- Aims of the course (effects of the course): **recognition of main measuring and realization principles of power system protections.**
- Form of the teaching (traditional/e-learning): **traditional**
- Course description:

**Objects and tasks of. power system protection. Main requirements related to power system relaying. Converters of measurement quantities for protection needs. Main criteria for detecting faults. Relaying principles of main power system elements, it is: generators, transformers, high voltage motors, distribution and transmission lines. Power system protection of preventive and restoration mode – object and general application principles.**

- Lecture:

<i>Particular lectures contents</i>	<i>Number of hours</i>
<b>1. The tasks of power system protection, ground definition and requirements</b>	<b>2</b>
<b>2. Relays and relay systems, relays generation, development</b>	

tendency	2
3. Converters of measuring quantities, instrument transformers, symmetrical components filters	2
4. Criteria for detecting faults for single input relays	2
5. Criteria for detecting faults for multi input relays (directional, differential, distance relays)	3
6. Synchronous generators protections	3
7. Transformer protections	3
8. High-voltage motors protections	3
9. Disturbances in distribution and transmission power systems	1
10. Distribution power system protections	3
11. Transmission power system protections	3
12. Object and principles of application related to protection of preventive and restoration mode	3

- Classes – the contents:

- Seminars – the contents:

- Laboratory – the contents:

1. Introduction, information about pass of grade form

2. Testing of current transformers

3. Testing of symmetrical components filters

4. Testing of single input relays

5. Testing of directional relays

6. Testing of differential relays

7. Testing of analogue distance relay

8. Testing of digital distance relay,

9. Testing of generator protections

- Project – the contents:

- Basic literature:

1. Ungrad H., Winkler W., Wiszniewski A., Protection techniques in electrical energy systems, Marcel Dekker Inc., New York 1995.

2. Horowitz S. H., Phadke A.G., Power system relaying, RSP England 1992.

3. Praca zbiorowa pod red. B. Synala, Automatyka elektroenergetyczna, ćwiczenia laboratoryjne, część I: Przetworniki sygnałów pomiarowych i przekaźniki automatyki zabezpieczeniowej, część II: Układy automatyki zabezpieczeniowej i regulacyjnej skrypt Politechniki Wrocł., Wrocław 1991.

- Additional literature:

1. Winkler W., Wiszniewski A., Automatyka zabezpieczeniowa w systemach elektroenergetycznych, WNT, Warszawa, 1999, oraz wydanie II 2004.

2. Synal B., Rojewski W., Dzierżanowski W., As above – wydanie II poprawione i uzupełnione, Wrocław 2003.

3. Wiszniewski A., Algorytmy pomiarów cyfrowych w automatyce elektroenergetycznej, WNT, W-wa, 1990.

4. Wróblewski J., Zespoły elektroenergetycznej automatyki zabezpieczeniowej, WNT, W-wa, 1993.

- Conditions of the course acceptance/creditation: Exam, Completion of Lab

\* - depending on a system of studies