

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Automatyka i bezpieczeństwo systemu elektroenergetycznego**
 Name in English: **Power System Automation and Security**
 Main field of study (if applicable): **Electrical Engineering**
 Specialization (if applicable): **Control in Electrical Power Engineering**
 Level and form of studies: **2nd level, full-time**
 Kind of subject: **obligatory**
 Subject code: **ELR032233**
 Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	30				15
Number of hours of total student workload (CNPS):	90				30
Form of crediting:	examination				crediting with grade
For group of courses mark (X) final course:					
Number of ECTS points:	3				1
including number of ECTS points for practical (P) classes :					1
including number of ECTS points for direct teacher-student contact (BK) classes:	2.10				0.70

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student has structured and theoretically founded knowledge necessary to understand phenomena associated with transient states under disturbances in networks and electrical machines
2. Has a basic knowledge on electric power protection
3. Is able to analyze properly selection joining and coordination of performance of elements and units of preventing and restitution automation
4. Is able to interpret the operation risk of electric power system and decide on selection of appropriate remedy
5. Is able to conduct work in a team and understands the need for continuous education

SUBJECT OBJECTIVES

- C1. Acquaintance of a student with basic knowledge needed to understand physical phenomena associated with transient states under disturbances in networks and electric machinery
- C2. Acquaintance with modern solutions of preventive and restitution automation with use of advanced digital techniques of data processing and transformation
- C3. Creation of skills and ability to recognition and ability to recognition and interpretation of risks arising from transient states under disturbances
- C4. The acquisition of a knowledge related to modern trends in control and safe management of supply and distribution of electric energy

SUBJECT EDUCATIONAL EFFECTS*relating to knowledge:*

- PEK_W01 Has detailed knowledge on methods of solution of safe control of automated electric power systems
- PEK_W02 Is able to decide on effective way to use elements of power restitution automation

relating to skills:

- PEK_U01 Able to obtain information from the literature and database on selected problems in the field of reliability, safety and modern concept of solutions of power systems protection
- PEK_U02 Able to formulate conclusion drawn from analysis of a selected power network concerning safe central and operation of automated electrical power systems

relating to social competences:

- PEK_K01 He has a sense of responsibility for his work and a willingness to comply with the principles of teamwork

PROGRAMME CONTENT		
Form of classes - lecture		Number of hours:
Lec 1	Acquaintance with the subject its program	2
Lec 2	Switching and auxiliary as contact as well as contactless units in automation, classification, parameters and category of utilizations, electrical and mechanical endurance	2
Lec 3	Reed relays and sensors, structure principle of operation, switching properties and application considerations	2
Lec 4	Advanced current converters for digital protections (Hall sensor, Rogowski coils etc)	2
Lec 5	Security problems in MV network with no effective earthing under a single phase grounding	2
Lec 6	Overvoltage protection in power system, external and internal threats, resonance phenomena	2
Lec 7	Power line carrier system (PLC) for central, management and data distribution in electric power networks	2
Lec 8	Coordinated central: automatic restoration, auto reclosing and load shedding in electric power system	2
Lec 9	Wide Area Protection System - application fields, GPS synchronization of measurements	2
Lec 10	Substation automation and integration - cooperation with SCADA system	2
Lec 11	Modern trends in substation automation - application of intelligent electric devices, internet - based solutions	2
Lec 12	Blackouts - reasons of wide area developing faults	2
Lec 13	Voltage and angle stability monitoring - PMU	2
Lec 14	Adaptive protection system	2
Lec 15	Summary and discussion of the final examination	2
Total hours:		30

Form of classes - seminar		Number of hours:
Sem 1	Acquaintance with program, requirements and way of completion, selection of problems itself	1
Sem 2	Individual tasks and projects for presentation of selected problems related to reliability, safe operation and modern solutions and concepts of automated electric power systems	14
Total hours:		15

TEACHING TOOLS USED	
N1. Lecture with use of audiovisual techniques, multimedia presentation, transparencies	
N2. Seminar with use of audiovisual techniques, multimedia presentation, transparencies	
N3. Problem discussion, consultation	

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT		
Evaluation <i>F - forming (during semester) P - concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F1(w)	PEK_W01 PEK_W02	Oral or written exam
P(w)	P=F1	
F1(s)	PEK_U01 PEK_U02	Assessment of individual presentation and students ability
F2(s)	PEK_U01 PEK_U02	Assessment of student activities under seminar
P(s)	P = 0,7F1 + 0,3F2	

PRIMARY AND SECONDARY LITERATURE	
PRIMARY LITERATURE:	
KTV Grattan, Sensors technology, Systems and Applications, A.Hilger IOP Publishing Ltd.1991 Power System Protection Vol.4 : Digital Protection and Signaling, Short Run Press Ltd. Exeter 1997 Ungrad H., Winkler W., Wiszniewski A., Protection Techniques in Electrical Energy Systems, Marcel Dekker Inc., New York 19	
SECONDARY LITERATURE:	
Wybrane artykuły publikowane w renomowanych czasopismach światowych	

SUBJECT SUPERVISOR
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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
ELR032233 - Power System Automation and Security
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Electrical Engineering**
AND SPECIALIZATION **Control in Electrical Power Engineering**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	S2CPE_W03 S2CPE_W09	C.1 C.2 C.4	Lec2 Lec3 Lec4 Lec7 Lec8 Lec9 Lec10 Lec12 Lec15	N.1
PEK_W02	S2CPE_W03 S2CPE_W09	C.2 C.3 C.4	Lec5 Lec6 Lec11 Lec12 Lec13 Lec14 Lec15	N.1
PEK_U01	S2CPE_U04	C.1 C.2 C.3 C.4	Sem1 Sem2	N.2 N.3
PEK_U02	S2CPE_U04	C.1 C.2 C.3 C.4	Sem1 Sem2	N.2 N.3
PEK_K01	S2CPE_K01	C.1 C.2 C.3 C.4	Lec1 Lec15 Sem1 Sem2	N.1 N.2 N.3