

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: **ELR052233**
 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 LEARNING OUTCOMES*relating to knowledge:*

- PEU_W01 Has detailed knowledge on methods of solution of safe control of automated electric power systems
 PEU_W02 Is able to decide on effective way to use elements of power restitution automation

relating to skills:

- PEU_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
 PEU_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:

- PEU_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 LEARNING OUTCOMES ACHIEVEMENT

Evaluation <i>F - forming (during semester) P - concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F1(w)	PEU_W01 PEU_W02	Oral or written exam
P(w)	P=F1	
F1(s)	PEU_U01 PEU_U02	Assessment of individual presentation and students ability
F2(s)	PEU_U01 PEU_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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