

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Sterowanie komputerowe systemami elektroenergetycznymi**
 Name in English: **Computer Control of Power System**
 Main field of study (if applicable): **Electrical Engineering**
 Specialization (if applicable): **Renewable Energy Systems**
 Level and form of studies: **2nd level, full-time**
 Kind of subject: **optional**
 Subject code: **ELR042535**
 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. Knowledge of basic problems of computer science.
2. Knowledge of basics of power systems.

SUBJECT OBJECTIVES

- C1. Knowing problems of computer control of modern power system.
 C2. Familiarizing with modern computer control of power system.
 C3. Familiarizing with modern techniques used in computer control of power system.
 C4. Enhancing practical skills in preparing presentation.
 C5. Enhancing practical skills in participating in discussion.

SUBJECT EDUCATIONAL EFFECTS*relating to knowledge:*

- PEK_W01 The student knows problems of power system control.
 PEK_W02 The student knows solutions of problems of power system control.

relating to skills:

- PEK_U01 The student is able to perform analyses of power systems from the view-point of their control.
 PEK_U02 The student is able to evaluate different solutions of problems of computer control of power system.

relating to social competences:

- PEK_K01 The student is able to prepare presentation in a problem manner.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours:
Lec 1	An introduction to the lecture, program of the lecture, requirements. Basic notions.	2
Lec 2	Open-system standard. Formulation of the problem of power system control.	2
Lec 3	Characteristics of system of power system control.	2
Lec 4	Problems of dispatcher power system control.	2
Lec 5	Characteristics of real-time power system modelling. The power system monitoring - generating topology model.	2
Lec 6	The power system monitoring - intelligent validation of measurement data and topology model.	2
Lec 7	Summation of problems of control and managing of a power system. Test.	2
Lec 8	Power system state estimation.	2
Lec 9	Utilization of current and voltage phasors for monitoring and controlling power system.	2
Lec 10	Utilization of artificial intelligence in computer systems for power system control: artificial neural network, expert systems.	2
Lec 11	Utilization of artificial intelligence in computer systems for power system control: fuzzy sets, genetic algorithms.	2
Lec 12	Elements of structural analysis of computer systems for power system control.	2
Lec 13	Elements of structural design of computer systems for power system control.	2
Lec 14	Cybersecurity of computer systems for power system control.	2
Lec 15	Summation of problems of utilizing of computers for monitoring and control of a power system. Test.	2
Total hours:		30

Form of classes - seminar		Number of hours:
Sem 1	Modern dispatcher centers of power system control.	2
Sem 2	Implementation of EMS systems.	2
Sem 3	Implementation of SCADA and MINISCADA systems.	2
Sem 4	Implementation of computer control of a substation.	2
Sem 5	Computer control in a power station.	2
Sem 6	Control of active power and frequency in a power system.	2
Sem 7	Control of voltage and reactive power in a power system.	2
Sem 8	Utilization of artificial intelligence in computer systems of power systems control.	1
Total hours:		15

TEACHING TOOLS USED

- N1. Multimedia presentation.
N2. Information lecture.

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	activity at the classes
F2(w)	PEK_W01 PEK_W02	tests
F3(w)	PEK_W01 PEK_W02	exam
P(w)	$P=0.1 F1 + 0.2 F2 + 0.7 F3$	
F1(s)	PEK_U01 PEK_U02	activity at the classes
F2(s)	PEK_U01 PEK_U02 PEK_K01	preparing seminar presentation
P(s)	$P=0.3 F1 + 0.7 F2$	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

- [1] Gładyś H., Komputery w kierowaniu pracą systemu elektroenergetycznego, WNT, Warszawa 1990.
- [2] Gładyś H., Praca elektrowni w systemie elektroenergetycznym, WNT, Warszawa 1999.
- [3] Kujszczyk Sz., Informatyzacja zakładów energetycznych, Warszawa, WNT 1990.
- [4] Strauss C., Practical electrical network automation and communication systems, Elsevier 2003.
- [5] Waha J. P. (Ed.), Control of power plants and power systems, Elsevier 2000.

SECONDARY LITERATURE:

- [1] Donald G. Fink, Standard Handbook for Electrical Engineers. Section 10: Power-System Components/SCADA. McGraw-Hill Professional 1999.
- [2] Flynn D. (Ed.), Thermal Power Plant Simulation and Control, The Institution of Engineering and Technology 2003.
- [3] Popovic D., Bhatkar V. P., Distributed Computer Control Systems in Industrial Automation, Marcel Dekker - Taylor & Francis 1990.
- [4] Artykuły w czasopismach technicznych takich jak np.: Energetyka, Biuletyn Miesięczny PSE itd

SUBJECT SUPERVISOR

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT **ELR042535 - Computer Control of Power System** AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Electrical Engineering** AND SPECIALIZATION **Renewable Energy Systems**

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	S2RES_W17	C.1	Lec1 Lec2 Lec3 Lec4 Lec7 Lec12 Lec14	N.1 N.2
PEK_W02	S2RES_W17	C.2 C.3	Lec4 Lec5 Lec6 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15	N.1 N.2
PEK_U01	S2RES_U19	C.4 C.5	Sem1 Sem2 Sem3 Sem4 Sem5 Sem6 Sem7	N.1
PEK_U02	S2RES_U19	C.4 C.5	Sem1 Sem2 Sem3 Sem4 Sem5 Sem6 Sem7 Sem8	N.1
PEK_K01	K2ETK_K06	C.4	Sem1 Sem2 Sem3 Sem4 Sem5 Sem6 Sem7 Sem8	N.1