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:	**ELR052535**
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 LEARNING OUTCOMES

relating to knowledge:

PEU_W01 The student knows problems of power system control.
PEU_W02 The student knows solutions of problems of power system control.

relating to skills:

PEU_U01 The student is able to perform analyses of power systems from the view-point of their control.
PEU_U02 The student is able to evaluate different solutions of problems of computer control of power system.

relating to social competences:

PEU_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 LEARNING OUTCOMES ACHIEVEMENT		
Evaluation *F – forming (during semester)* *P – concluding (at semester end)*	**Educational effect number**	**Way of evaluating educational effect achievement**
F1(W)	PEU_W01 PEU_W02	activity at the classes
F2(W)	PEU_W01 PEU_W02	tests
F3(W)	PEU_W01 PEU_W02	exam
P(W)	P=0.1 F1 + 0.2 F2 + 0.7 F3	
F1(S)	PEU_U01 PEU_U02	activity at the classes
F2(S)	PEU_U01 PEU_U02 PEU_K01	preparing seminar presentation
P(S)	P=0.3 F1 + 0.7 F2	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Murty P.S.R., Operation and Control in Power Systems, CRC Press, 2011.
[2] Milano F., Advances in power system modelling control and stability analysis, IET, London 2016.
[3] Strauss C., Practical electrical network automation and communication systems, Elsevier 2003.
[4] Waha J. P. (Ed.), Control of power plants and power systems, Elsevier 2000.
[5] Wood A.J., Wollenberg B.F., Sheblé G.B., Power Generation, Operation, and Control, John Wiley & Sons, Inc., Hoboken, New Jersey 2013.

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] Artykuły w czasopismach technicznych takich jak np.: Energetyka, Biuletyn Miesięczny PSE itd

SUBJECT SUPERVISOR

Kazimierz Wilkosz, kazimierz.wilkosz@pwr.edu.pl