FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Systemy sterowania i kontroli w elektroenergetyce**
Name in English:	**Electric power system control and operation**
Main field of study (if applicable):	**Control Engineering and Robotics**
Specialization (if applicable):	**Automation and Control in Electrical Power Systems**
Level and form of studies:	**2nd level, full-time**
Kind of subject:	**obligatory**
Subject code:	**ARR042211**
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):	60		30		
Form of crediting:	crediting with grade		crediting with grade		
For group of courses mark (X) final course:					
Number of ECTS points:	2		1		
including number of ECTS points for practical (P) classes :			1		
including number of ECTS points for direct teacher-student contact (BK) classes:	1.40		0.70		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knows principles of operation of electric power system as well as technologies of electrical energy generation, transmission and distribution.
2. Understands role and purpose of power system protection.
3. Is able to work on MATLAB Simulink package.
4. Is able to work in team as well as independently

SUBJECT OBJECTIVES

C1. Acquaintance with power system automation and control units.
C2. Acquaintance with data types gathered on each stage of power system structure.
C3. Acquaintance with methods of realization of swing prevention automation in power system.
C4. Acquaintance with functions of dispatcher systems applied on different levels of management of Polish Power System
C5. Gaining practical skills for conducting computer simulation of transients in power system

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 Has knowledge about the kind of automatics used in power system.
PEK_W02 Has knowledge about data transmission techniques used in power system.
PEK_W03 Has knowledge about dispatcher systems applied on different levels of management of Polish Power System

relating to skills:

PEK_U01 Is able to prepare data and use it with MATLAB Simulink model and conduct simulations of transients in power system.
PEK_U02 Is able to prepare simulation report and formulate conclusions

relating to social competences:

PEK_K01 Is conscious about responsibility for his work and ready to work in team.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours:**
Lec 1	Electrical power system as object for monitoring and control.	2
Lec 2	Classification of automatics and control systems applied in power system.	2
Lec 3	Data gathering and transmission. Tele-control and telemetry systems.	2
Lec 4	Synchro-phasors. Wide-area measurement systems in power system.	2
Lec 5	SCADA/EMS in power system.	2
Lec 6	Preventive automatics in power system: Load-Frequency-Shedding and Undervoltage-Load-Shedding.	2
Lec 7	Wide-area protection with anti-swings functions.	2
Lec 8	Load and generation control.	2
Lec 9	Monitoring and control of distribution system	2
Lec 10	Structure and functions of monitoring system of Polish Power System.	2
Lec 11	Power system and power plant operators cooperation system	2
Lec 12	Monitoring and control system for 110kV substation.	2
Lec 13	Volt/VAR Control	2
Lec 14	Monitoring and control system in the Country Power Dispatching	2
Lec 15	Assessment test.	2
	Total hours:	**30**

Form of classes - laboratory		**Number of hours:**
Lab 1	Presentation of safety regulations and internal regulations of laboratory. Assessment rules. Overview of laboratory stations.	3
Lab 2	Simulation of impact of turbine fast valving (FV) on damping of generator rotor swings	3
Lab 3	Simulation of turbine fast valving (FV) influence on operation of distance protection	3
Lab 4	Simulation of generator excitation forcing on damping of rotor swings	3
Lab 5	Simulation of D-STATCOM automatic operation in power distribution system	3
	Total hours:	**15**

TEACHING TOOLS USED

N1. Problem lecture
N2. Lecture with use of multimedia techniques.
N3. Laboratory with measurements traditionally arranged, work in groups
N4. Oral assessment
N5. Report arrangement from tests and simulations

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation *F – forming (during semester) P – concluding (at semester end)*	**Educational effect number**	**Way of evaluating educational effect achievement**
F1(W)	PEK_W01 PEK_W02 PEK_W03	Oral and writing test
P(W)	P=F1	
F1(L)	PEK_U01 PEK_K01	Assessment of preparation for laboratory. Activity during laboratory
F2(L)	PEK_U02 PEK_K01	Assessment of prepared laboratory reports
P(L)	P = 0,5F1+ 0,5F2	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Machowski J., Regulacja i stabilność systemu elektroenergetycznego. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2007.
[2] Kowalik R., Pawlicki C.: Podstawy teletechniki dla elektryków. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2006.

SECONDARY LITERATURE:

[1] Instrukcja ruchu i eksploatacji sieci przesyłowej (IRiESP), PSE-Operator SA. Internet.

SUBJECT SUPERVISOR
Krzysztof Billewicz, krzysztof.billewicz@pwr.edu.pl

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
ARR042211 - Electric power system control and operation
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Control Engineering and Robotics**
AND SPECIALIZATION **Automation and Control in Electrical Power 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	S2ASE_W01	C.1	Lec1 Lec2	N.1 N.2
PEK_W02	S2ASE_W01	C.2	Lec3 Lec4 Lec5	N.1 N.2
PEK_W03	S2ASE_W01	C.3 C.4	Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14	N.1 N.2
PEK_U01	S2ASE_U01	C.5	Lab1 Lab2 Lab3 Lab4 Lab5	N.3 N.4 N.5
PEK_U02	S2ASE_U01	C.5	Lab2 Lab3 Lab4 Lab5	N.3 N.4 N.5
PEK_K01	K2AiR_K02	C.5	Lab2 Lab3 Lab4 Lab5	N.3 N.4 N.5