FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Sterowanie rozproszone w elektroenergetyce**
Name in English:	**Distributed control systems for electric power**
Main field of study (if applicable):	**Industrial Control Engineering**
Specialization (if applicable):	
Level and form of studies:	**1st level, full-time**
Kind of subject:	**optional**
Subject code:	**APR012505**
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. Basic knowledge of the theory of electrical power system
2. Basic knowledge of the theory of automation and control systems

SUBJECT OBJECTIVES

C1. Mastering the theory DCS distributed control in the development of typical control structures used in the control system of the power unit

C2. To acquire knowledge about distributed measurement and wide area measurement systems and its features to the special functions of the EMS and automatic short circuit protection

SUBJECT LEARNING OUTCOMES

relating to knowledge:

PEU_W01 The student has an extended knowledge about the architecture of distributed control systems and WAMS

PEU_W02 Student knows the control algorithms used in autonomous dispersed control system

relating to skills:

PEU_U01 Able to obtain information from the literature and database on selected problems in the field of modern concept of solutions of power systems protection

PEU_U02 Competently and independently, can develop a complex presentation in the wider automation based on multi-criteria analysis and deliver a presentation

relating to social competences:

PEU_K01 Student be able to collaborate and work in the group

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours:**
Lec 1	Acquainted with the program of the classes, requirements and assessment. The history of development, architecture and functionality of power systems	2
Lec 2	Distributed Power Systems: An Energy Revolution	2
Lec 3	Environment Monitoring System (EMS) functions - in normal operation states of the power system. The evolution of SCADA systems	2
Lec 4	Wide area measurement systems (WAMS)	2
Lec 5	Synchronized phasor measurements of voltages and currents from widely dispersed locations in an electric power grid	2
Lec 6	Wide Area Monitoring Systems - communication platform	2
Lec 7	WAMS advanced applications to voltage stability	2
Lec 8	WAMS advanced applications to frequency stability	2
Lec 9	WAMS advanced applications to transient stability	2
Lec 10	Self-healing power systems	2
Lec 11	Architecture and functionality of a distributed control system (DCS)	2
Lec 12	The basic structure of regulation - theory and real implementation - control loop with PID controller	2
Lec 13	The basic structure of regulation - theory and real implementation - control algorithms feed-forward	2
Lec 14	The main power boiler control loops - theory and real implementation - simulation of the boiler and turbine control	2
Lec 15	Knowledge evaluation test	2
	Total hours:	**30**

Form of classes - seminar		**Number of hours:**
Sem 1	Familiarization with the programme, requirements and a way of course passing. Seminar topic selection	2
Sem 2	Presentation of the results of work related to performed selected topic	13
	Total hours:	**15**

TEACHING TOOLS USED
N1. Academic lecture
N2. Problem-solving discussion

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	Colloquium during classes, oral answers
P(W)	P=F1	
F1(S)	PEU_U01	Evaluation of individual presentations of students
F2(S)	PEU_U02	Evaluation of activity during the seminar
P(S)	P=0,7F1+0,3F2	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] P. Tatjewski Sterowanie zaawansowane obiektów przemysłowych, Struktury i algorytmy, Akademicka Oficyna Wydawnicza EXIT, Warszawa 2002.
[2] Korbicz J., Kościelny J. Modelowanie, diagnostyka i sterowanie nadrzędne procesami. Implementacja w w systemie DiaSter,., WNT, Warszawa 2009.
[3] D. Laudyn, M. Pawlik, and F. Strzelczyk , Elektrownie , Wydawnictwo Naukowo-Techniczne, Warszawa, 2000.

SECONDARY LITERATURE:

[1] DCS and PLC/SCADA – a comparison in use, Control Engineering UK, 2011
[2] S. G. Dukelow, The Control of Boilers", 2nd edition, , publisher ISA, USA, 1991
[3] http://www.dcscenter.com/

SUBJECT SUPERVISOR

Robert Lis, robert.lis@pwr.edu.pl