FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Kierowanie i sterowanie systemem elektroenergetycznym**
Name in English:	**Electric Power System Operation and Control**
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:	**ELR042531**
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. Knowledge of basics of power system control and three-phase and single-phase electric circuits analysis
2. Practical skills of using MATLAB
3. The student can build on Ohm's low and Kirchhoff's lows and matrix calculus for the steady-state and transient short circuit linear analysis

SUBJECT OBJECTIVES

C1. Acquaintance of knowledge related to transmission and distribution of electricity
C2. Practical skills to analyze and design of modeling of a power system under normal and abnormal states

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01	Knows the rules of the functioning of the power system
PEK_W02	The student has a thorough knowledge of power system calculations performed under normal, abnormal states and short-circuits

relating to skills:

PEK_U01	Is able to develop the equivalent circuit of power systems in the steady state, short-circuit and transient states and calculate equivalent circuit parameters
PEK_U02	Student is able to apply results of computer simulation to analyse of static electric circuits

relating to social competences:

PEK_K01	Student can act independently and cooperate within a group working on a complex engineering project.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours:**
Lec 1	Introduction. Setting rules of course crediting. Historical perspective, development of electrical power systems	2
Lec 2	Models of basic elements of electrical power systems	2
Lec 3	Mathematical background of load flow analysis	2
Lec 4	Iterative solution of active and reactive power flows using Matlab	2
Lec 5	Example of hand and computer calculations of load flow	2
Lec 6	Voltage and reactive power regulation	2
Lec 7	Voltage stability of power system using Matlab - detailed algorithms	2
Lec 8	Symmetrical short-circuit in electrical power systems	2
Lec 9	Analysis of unbalanced faults using the symmetrical component transformation	2
Lec 10	IEC method of short-circuit analysis. Example of short-circuit analysis	2
Lec 11	Short-circuit analysis using Matlab	2
Lec 12	Synchronous generator models in stability analysis	2
Lec 13	Transient stability of a synchronous generator connected to a large power system. Differential equations of generator and voltage and speed regulators	2
Lec 14	Design of small disturbance stability of a synchronous generator connected to a large electric power system	2
Lec 15	Final test	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	Indiwidual tasks and projects for presentation of selected problems related to steady-state analysis, voltage stability, local and transient stability of the power system using MATLAB	2
Sem 3	Project ideas presentations related to the steady-state analysis, voltage stability, local and transient stability of the power system using.	10
Sem 4	Summary of seminar and classification	2
	Total hours:	**15**

TEACHING TOOLS USED

N1. General lecture
N2. Seminar with use of audiovisual techniques, multimedia presentation
N3. Problem discussion, consultation

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**
F(W)	PEK_W01 PEK_W02	Oral or written test
P(W)	P=F1	
F1(S)	PEK_U01 PEK_U02	Evaluation of individual presentation and students ability
F2(S)	PEK_U01	Assessment of student activities under seminar
P(S)	P = 0,7F1 + 0,3F2	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Sobierajski M, Łabuzek M., Lis R, Electric Power System Analysis in Matlab.. Wrocław, Wyd. PWr, 2007
[2] Machowski J., Białek J.,Bumby J., Power System Dynamics and Stability, Wiley, 2005.
[3] Kremens Z., Sobierajski M., Analiza systemów elektroenergetycznych. Warszawa. WNT 1996.

SECONDARY LITERATURE:

[1] Selected articles published in refereed or reputable academic journals

SUBJECT SUPERVISOR

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
ELR042531 - Electric Power System Operation and Control
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Electrical Engineering**
AND SPECIALIZATION **Control in Electrical Power Engineering**

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	S2CPE_W06	C.1	Lec1 Lec2	N.1
PEK_W02	S2CPE_W06	C.1 C.2	Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15	N.1 N.3
PEK_U01	S2CPE_U07	C.2	Sem1 Sem2	N.2 N.3
PEK_U02	S2CPE_U07 S2CPE_U10	C.1 C.2	Sem2 Sem3 Sem4	N.2 N.3
PEK_K01	K2ETK_K07	C.1 C.2	Sem3 Sem4 Sem5 Sem6 Sem7	N.3