FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Systemy elektroenergetyczne 2**
Name in English:	**Electric Power Systems 2**
Main field of study (if applicable):	**Electrical Engineering**
Specialization (if applicable):	
Level and form of studies:	**1st level, full-time**
Kind of subject:	**obligatory**
Subject code:	**ELR052506**
Group of courses:	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	15		30		
Number of hours of total student workload (CNPS):	30		60		
Form of crediting:	examination		crediting with grade		
For group of courses mark (X) final course:					
Number of ECTS points:	1		2		
including number of ECTS points for practical (P) classes :			2		
including number of ECTS points for direct teacher-student contact (BK) classes:	0.70		1.40		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student has the knowledge of the analysis methods of steady and short-circuits states in electric power systems.
2. Student has the basic knowledge of the control theory in the field of dynamic stability of technical systems.
3. Student has the basic knowledge of programming in Matlab.
4. Student is capable of using differentiation and integration for the analysis of steady and transient states of linear electric circuits.
5. Student is capable of using the knowledge of electric drives for modeling the generator in subtransient , transient and synchronous states.
6. Student is capable of using Matlab for the analysis of electric power system states.
7. Student can work in a team.
8. Student understands the need of various knowledge to integrate.

SUBJECT OBJECTIVES

C1. To assimilate knowledge associated with the voltage and frequency control in electric power systems.

C2. To become skillful at the analysis of steady, short-circuits and transient states of electric power system examples

SUBJECT LEARNING OUTCOMES

relating to knowledge:

PEU_W01	Student has the basic knowledge concerning the rules of the voltage and frequency control and the power system stability.
PEU_W02	Student has the well-ordered knowledge concerning the computation of the steady, short-circuits and transient states of electric power systems.

relating to skills:

PEU_U01	Student can work out the equivalent schemes of power system in steady, short-circuits and transient states and calculate the equivalent parameters.
PEU_U02	Student is capable of preparing input data and making computer simulation of power system states. PEK_U03. Student is capable

relating to social competences:

PEU_K01	Student is aware of the responsibility for making decisions on power systems.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours:**
Lec 1	Introduction to the analysis of transient electromechanical states.	2
Lec 2	The small disturbance of power systems.	2
Lec 3	Using the equal area method for the stability examination. Individual work.	2
Lec 4	The quality of electric energy - requirement and standards.	2
Lec 5	The voltage control in electric power systems.	2
Lec 6	The voltage stability of electric power systems.	2
Lec 7	The frequency control in electric power systems.	2
Lec 8	Smart power grids.	1
	Total hours:	**15**

Form of classes - laboratory		**Number of hours:**
Lab 1	Introduction - the health and safety requirements, the rules of making laboratory exercises	2
Lab 2	Load flow calculation in radial transmission system.	2
Lab 3	Preparing equivalent schemes and input data for load flow computation in per unit.	2
Lab 4	Iterative computation of load flow in power system.	2
Lab 5	The control of voltage and tap transformers to minimize the transmission power losses.	2
Lab 6	Preparing equivalent schemes and parameters in the symmetrical component system of 012.	2
Lab 7	The computation of the initial symmetrical short-circuit currents supplied by independent sources.	2
Lab 8	The computation of the initial, peak, breaking and thermal equivalent short-circuit currents according to IEC.	2
Lab 9	Preparing the input data file for the analysis of unsymmetrical short-circuits. Computing the impedance matrix in the symmetrical component system of 012.	2
Lab 10	The computation of the initial current in 1-phase and 2-phase short-circuits in the solidly grounded network.	2
Lab 11	Limiting the short-circuit currents and checking the effectiveness of the solidly grounding.	2
Lab 12	The analysis of 1-phase short-circuit in the middle voltage network.	2
Lab 13	Badanie stabilności metodą równych pól układu przesyłowego: system sztywny - generator.	2
Lab 14	Simultaing the transient stability of single generator system by numerical integration.	2
Lab 15	Final test.	2
	Total hours:	**30**

TEACHING TOOLS USED
N1. Information lecture and multimedia presentation.
N2. Presenting problems in the form of individual controlled work.
N3. Laboratory group controlled by checking knowledge and exercise performance.
N4. Checking the knowledge and acquired experience by final test.

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	Individual work
F2(W)	PEU_W01 PEU_W02	Written examination.
P(W)	P=0.4F1+0.6F2	
F1(L)	PEU_U01 PEU_U02	The mark of preparing for the laboratory exercises.
F2(L)	PEU_U01 PEU_U02	The mark of reports.
F3(L)	PEU_U01 PEU_U02	Final laboratory test.
P(L)	P=0.3F1 + 0.4F2+0.3F3	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Kremens Z., Sobierajski M.,Electric power system Analysis. Warsaw WNT 1996 . /in polish/
[2] Kacejko P., Machowski J., Short-circuits in electric power systems. Warsaw WNT 2002. /in polish/
[3] Electric power system lecture accessible at http://eps.pwr.wroc.pl/studenci. /in polish/

SECONDARY LITERATURE:

[1] Kacejko P., Dispersed generation in electric power system. Wydawnictwa Politechniki Lubelskiej 2004. /in polish/
[2] Sobierajski M., Łabuzek M., Programming in Matlab. Oficyna Wydawnicza Politechniki Wrocławskiej, 2005. /in polish/
[3] Lecture of Informatics in electrical engineering accessible at http://eps.pwr.wroc.pl/studenci /in polsh/

SUBJECT SUPERVISOR

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