

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Nowoczesne technologie w przesyłach i rozdziale energii elektrycznej**
 Name in English: **Modern technologies in electric power transmission and distribution**
 Main field of study (if applicable): **Electrical Engineering**
 Specialization (if applicable): **Electrical Power Engineering**
 Level and form of studies: **2nd level, full-time**
 Kind of subject: **obligatory**
 Subject code: **ELR042515**
 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 physical phenomena in power systems.
2. Knowledge of basic methods of analyses of power systems.
3. Ability of preparing of multimedia presentation on a given topic.
4. The student is able to think and act creatively.
5. The student is able alone to learn earlier-unknown problem.

SUBJECT OBJECTIVES

- C1. Understanding of tendencies in power system development.
- C2. Understanding significance and principles of operation of power electronic devices utilized in transmission and distribution of electric energy.
- C3. Understanding modern techniques of solving problems of power system planning, exploitation and control.

SUBJECT EDUCATIONAL EFFECTS*relating to knowledge:*

- PEK_W01 The student knows modern technologies of transmission of electrical energy.
- PEK_W02 The student knows trends in the scope of power system development and exploitation.
- PEK_W03 The student knows modern techniques utilized in analyses related to transmission and distribution networks.

relating to skills:

- PEK_U01 The student is able to perform more advanced analyses of power systems.
- PEK_U02 The student is able to evaluate different solutions of problems related to power system.

relating to social competences:

- PEK_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. General characteristics of a transmission of alternating current (basic relationships, static limits of electric power transmission, classical control of power transmission).	2
Lec 2	Dynamic aspects of control of active and reactive power flows in a power system.	2
Lec 3	Need of introduction of FACTS devices into transmission and distribution power networks (a general idea of FACTS, development of FACTS in the past, directions of development and solved problems).	2
Lec 4	UPFC devices as devices combining properties of different FACTS devices (principles of operation, schemes, properties, utilization).	2
Lec 5	Direct current (DC) solutions in power systems: DC power lines, back-to-back power stations.	2
Lec 6	Modern dispatcher power-system control.	2
Lec 7	Intelligent data processing in substation for purposes of power-system monitoring.	2
Lec 8	Power system state estimation. Test.	2
Lec 9	Modern techniques for solving problems related to transmission and distribution networks - utilization of expert systems and artificial neural networks.	2
Lec 10	Modern techniques for solving problems related to transmission and distribution networks - utilization of genetic algorithms and fuzzy logic.	2
Lec 11	Actual solutions of reactive power management in power systems.	2
Lec 12	Contemporary ways of solving problems of harmonics in power systems.	2
Lec 13	Modern technologies of construction of power lines.	2
Lec 14	Trends in development and exploitation of distribution network. Micro-grids.	2
Lec 15	A summary of trends in transmission and distribution of electrical energy. Test.	2
Total hours:		30

Form of classes - seminar		Number of hours:
Sem 1	At-present-observed changes in development of transmission and distribution power networks.	2
Sem 2	Different kinds of control of active and reactive power flows in a power system	2
Sem 3	Utilization of power electronic devices in transmission and distribution power networks	2
Sem 4	Ideas of reactive power compensation in power networks.	2
Sem 5	Classical ways of reactive power compensation in a power system.	1
Sem 6	Modern ways of reactive power compensation in a power system.	2
Sem 7	Trends in dispatcher control of power system on different levels.	2
Sem 8	Modern computational techniques utilized for solving problems encountered in broadly understood power system planning, exploitation, and control.	2
Total hours:		15

TEACHING TOOLS USED

- N1. Multimedia presentation.
N2. Information lecture.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation <small>F - forming (during semester) P - concluding (at semester end)</small>	Educational effect number	Way of evaluating educational effect achievement
F1(w)	PEK_W01 PEK_W02 PEK_W03	activity at the classes
F2(w)	PEK_W01 PEK_W02 PEK_W03	the grades from test
F3(w)	PEK_W01 PEK_W02 PEK_W03	exam
P(w)	$P=0.1 F1 + 0.2 F2 + 0.7 F3$	
F1(s)	PEK_U01 PEK_U02	activity at the classes
F2(s)	PEK_U01 PEK_U02 PEK_K01	preparing seminar presentation
P(s)	$P=0.3 F1 + 0.7 F2$	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

- [1] Z. Kremens, M. Sobierajski, Analiza systemów elektroenergetycznych, WNT, Warszawa 1996.
- [2] K. Kinsner, A. Serwin, M. Sobierajski, A. Wilczyński, Sieci elektroenergetyczne. Wyd. PWr Wrocław, 1993.
- [3] V.K.Sood, HVDC and FACTS Controllers. Application of Static Converters in power System, , Kluwer Academic Publishersl, New York 2004.
- [4] R. Strzelecki, G. Benysek, Power Electronics in Smart Electrical Energy Networks, London, Springer Verlag 2008.
- [5] Praca Zbiorowa, Elektroenergetyczne układy przesyłowe., WNT, Warszawa 1997.
- [6] Helt P., Parol M., Piotrowski P., Metody sztucznej inteligencji w elektroenergetyce Wydawnictwo Politechniki Warszawskiej, Warszawa 2000.

SECONDARY LITERATURE:

- [1] S. Bernas, Systemy elektroenergetyczne, WNT, Warszawa 1982.
- [2] R. Barlik, M. Nowak, Technika tyrystorowa, WNT, Warszawa 1994.
- [3] K. Tunia, B. Winiarski, Energoelektronika., WNT, Warszawa 1994.
- [4] K. Tunia, B. Winiarski, Energoelektronika w pytaniach i odpowiedziach., WNT, Warszawa 1996.
- [5] Publikacje w czasopismach z zakresu elektroenergetyki.

SUBJECT SUPERVISOR

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

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT **ELR042515 - Modern technologies in electric power transmission and distribution** AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Electrical Engineering** AND SPECIALIZATION **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	S2EEN_W01 S2EEN_W06	C.2	Lec1 Lec2 Lec3 Lec4 Lec5 Lec13	N.1 N.2
PEK_W02	S2EEN_W06	C.1	Lec6 Lec7 Lec9 Lec10 Lec14	N.1 N.2
PEK_W03	S2EEN_W06	C.3	Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec15	N.1 N.2
PEK_U01	S2EEN_U07	C.1 C.2 C.3	Sem1 Sem2 Sem3 Sem4 Sem5 Sem6 Sem7 Sem8	N.1
PEK_U02	K2ETK_U07 S2EEN_U07	C.1 C.3	Sem1 Sem2 Sem3 Sem4 Sem5 Sem6 Sem7 Sem8	N.1
PEK_K01	K2ETK_K06	C.1 C.3	Sem1 Sem2 Sem3 Sem4 Sem5 Sem6 Sem7 Sem8	N.1