FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Nowoczesne technologie w przesyle 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:	**ELR052515**
Group of courses:	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	30				
Number of hours of total student workload (CNPS):	90				
Form of crediting:	examination				
For group of courses mark (X) final course:					
Number of ECTS points:	3				
including number of ECTS points for practical (P) classes:					
including number of ECTS points for direct teacher-student contact (BK) classes:	2.10				

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.

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 LEARNING OUTCOMES

relating to knowledge:

PEU_W01 The student knows modern technologies of transmission of electrical energy.

PEU_W02 The student knows trends in the scope of power system development and exploitation.

PEU_W03 The student knows modern techniques utilized in analyses related to transmission and distribution networks.

relating to skills:

relating to social competences:

PEU_K01 understands the need for live long learning and rising qualifications

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	A summary of analyses of power system from the point of view of reactive power compensation. Test.	2
Lec 7	Modern dispatcher power-system control.	2
Lec 8	Intelligent data processing in substation for purposes of power-system monitoring.	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**

TEACHING TOOLS USED
N1. Multimedia presentation.
N2. Information lecture.

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 PEU_W03 PEU_K01	activity at the classes
F2(W)	PEU_W01 PEU_W02 PEU_W03 PEU_K01	the grades from test
F3(W)	PEU_W01 PEU_W02 PEU_W03 PEU_K01	exam
P(W)	P=0.1 F1 + 0.2 F2 + 0.7 F3	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] M. Eremia, Chen-Ching Liu, Abdel-Aty Edris, Advanced Solutions in Power Systems: HVDC, FACTS, and Artificial Intelligence. Wiley-IEEE Press 2016.
[2] Z. Kremens, M. Sobierajski, Analiza systemów elektroenergetycznych, WNT, Warszawa 1996.
[3] K. Kinsner, A. Serwin, M. Sobierajski, A. Wilczyński, Sieci elektroenergetyczne. Wyd. PWr Wrocław, 1993.
[4] V.K.Sood, HVDC and FACTS Controllers. Application of Static Converters in power System, , Kluwer Academic Publishersl, New York 2004.
[5] R. Strzelecki, G. Benysek, Power Electronics in Smart Electrical Energy Networks, London, Springer Verlag 2008.
[6] Praca Zbiorowa, Elektroenergetyczne układy przesyłowe., WNT, Warszawa 1997.
[7] 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
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