FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Zaawansowane technologie produkcji energii elektrycznej**
Name in English:	**Advanced Technology in Electrical Power Generation**
Main field of study (if applicable):	**Electrical Engineering**
Specialization (if applicable):	**Renewable Energy Systems**
Level and form of studies:	**2nd level, full-time**
Kind of subject:	**obligatory**
Subject code:	**ESN001501**
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:	crediting with grade	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. Knows basic laws of physics, chemistry, has the knowledge of the description of processes and properties for ideal gases including thermodynamic processes for water vapor and basic knowledge in the field of fuel
2. Is able apply the knowledge of differential and integral calculus of functions of one variable and use mass and energy balance.

SUBJECT OBJECTIVES

C1. Getting the knowledge the fundamental processes describing the generation of electricity and methods for assessing the energy balance of energy production systems

C2. Acquire practical skills of efficiency and energy balance determination for advanced energy production system from conventional and renewable energy sources.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 Have knowledge of fundamental principles of different power production systems at high efficiency.

PEK_W02 Knows principles of power production systems configurations including conventional unit depending on primary energy carrier .

relating to skills:

PEK_U01 Is able to perform critical analysis of advanced concept of power systems especially near zero emission technology using different types of primary Energy sources.

PEK_U02 Is able to perform of thermodynamics efficiency calculation for thermal, cogeneration and combined power unit

relating to social competences:

PEK_K01 Assess the energy needs of countries depending on local resources.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours:**
Lec 1	Energy in the future Challenges for the 21st Century	2
Lec 2	Impact of climate changes on progress low emission power production technology	2
Lec 3	Physical and Chemical fundamentals of power production	2
Lec 4	Combustion and Gasification of fuels	2
Lec 5	Thermodynamical fundamentals of power production	2
Lec 6	Vapor Power Cycle – improvement of efficiency	2
Lec 7	Super critical boilers in advanced power unit	2
Lec 8	Cogeneration system of energy production	2
Lec 9	Fundamental of combined power plant.	2
Lec 10	IGCC – Integrated gasification coal combined plants - fundamentals	2
Lec 11	Advanced power unit integrated with SOFC- fuel cel.	2
Lec 12	Fundamentals of CCS technology – carbon capture and storage	2
Lec 13	Nuclear Power Plants	2
Lec 14	Hybrid power unit , polygeneration with RES	2
Lec 15	Test (crediting with grade)	2
	Total hours:	**30**

Form of classes - class		**Number of hours:**
Cl 1	Calculation of combustion air and the quantities and composition of exhaust gases from fuel combustion in thermal power plants	2
Cl 2	Calculation of cycle efficiency thermal power plant for sub-critical parameters	2
Cl 3	Calculation of cycle efficiency thermal power plant for sub-critical parameters with reheated of steam system	2
Cl 4	Calculation of cycle efficiency thermal power plant for sub-critical parameters with reheated of steam system and regeneration system.	2
Cl 5	Calculation of cogeneration cycle efficiency	2
Cl 6	Calculation of cycle efficiency of combined power unit	2
Cl 7	The calculation of the balance of coal-fired thermal power plant with CO2 capture by amine absorption	2
Cl 8	Test (crediting with grade)	1
	Total hours:	**15**

TEACHING TOOLS USED
N1. Lectures with multimedia presentation
N2. Students own work
N3. Classes
N4. Discussion of results
N5. Colloquium

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**
F1(W)	PEK_W01 PEK_W02	test
P(W)	P=F1	
F1(C)	PEK_U01 PEK_U02 PEK_K01	Evaluation of home works
F2(C)	PEK_U01 PEK_U02 PEK_K01	Test
P(C)	P=0,3F1+0,7F2	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Advanced Power Genertion technology, RES, H. Pawlak-Kruczek, 2011
[2] Yunus A. Cengel, Michael A. Boles , Thermodynamics, An Engineering Approach. McGraw –Hill Higher Education ,2009
[3] Theory And Problems Of Thermodynamics For Engineers, Merle C. Potter, Craig W,Somerton, Ph,D.,Associate Professor Of Mechanical Engineering,Michigan State University, Schaum's Outline Series, Mcgraw-Hill, 2008
[4] Prabir Basu , Cen Kefa, Louis Jestin, Boilers and Burners , Design and Theory , Springer, 2013

SECONDARY LITERATURE:

[1] Steam/its generation and use - 42nd Edition, Copyright © 2015 by The Babcock & Wilcox Company Forty-second edition
[2]J.M. Beer, High efficiency electric power generation: The environmental role; Progress in Energy and Combustion Science 33 (2007), 107–134

SUBJECT SUPERVISOR

Halina Pawlak-Kruczek, halina.kruczek@pwr.edu.pl

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
ESN001501 - Advanced Technology in Electrical Power Generation
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Electrical Engineering**
AND SPECIALIZATION **Renewable Energy Systems**

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	S2RES_W14	C.1 C.2	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15	N.1 N.2 N.5
PEK_W02	S2RES_W14	C.1 C.2	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15	N.1 N.2 N.5
PEK_U01	S2RES_U15	C.1 C.2	Cl1 Cl2 Cl3 Cl4 Cl5 Cl6 Cl7 Cl8	N.1 N.2 N.3 N.4 N.5
PEK_U02	S2RES_U15	C.1 C.2	Cl1 Cl2 Cl3 Cl4 Cl5 Cl6 Cl7 Cl8	N.1 N.2 N.3 N.4 N.5
PEK_K01	K2ETK_K03	C.1 C.2	Cl1 Cl2 Cl3 Cl4 Cl5 Cl6 Cl7 Cl8	N.1 N.2 N.3 N.4 N.5