

(faculty stamp)

**COURSE DESCRIPTION**

Z1-PU7

WYDANIE N1

Strona 1 z 2

<b>1. Course title: MODERNIZATION OF POWER PLANTS</b>		<b>2. Course code</b>		
<b>3. Validity of course description:</b> from 2012/2013				
<b>4. Level of studies:</b> 1 <sup>st</sup> cycle of higher education				
<b>5. Mode of studies:</b> intramural studies				
<b>6. Field of study:</b> ENERGY ENGINEERING		(FACULTY SYMBOL) RIE		
<b>7. Profile of studies:</b> academic				
<b>8. Programme:</b> MODERNIZATION OF POWER SYSTEMS				
<b>9. Semester:</b> 6				
<b>10. Faculty teaching the course:</b> Faculty of Energy and Environmental Engineering, Institute of Power Engineering and Turbomachinery				
<b>11. Course instructor:</b> Prof. Marek Pronobis				
<b>12. Course classification:</b> specialized subjects				
<b>13. Course status:</b> compulsory				
<b>14. Language of instruction:</b> English				
<b>15. Pre-requisite qualifications:</b> basics of chemistry, physics, thermodynamics, material science, strength of materials, steam generators				
<b>16. Course objectives:</b> An introduction to the modernization of power systems to improve their efficiency and the ecological impact				
<b>17. Description of learning outcomes:</b>				
Nr	Learning outcomes description	Method of assessment	Teaching methods	Learning outcomes reference code
1.	Identifies problems imposing the necessity for modernization of power systems	Test	Lecture	K_W11 K_W17 K_W18
2.	Identifies and describes the directions of modernization of elements power plant	Test	Lecture	K_W18 K_W24 K_U23
3.	Describes the ways to improve the efficiency and the environmental impact of power boilers	Test	Lecture	K_U25 K_U22
4.	Describes the ways to improve the efficiency of turbines and generators	Test	Lecture,	K_U22 K_U23
5.	Describes the ways of modernizations in order to decrease Sox, NOx and PM emissions	Test	Lecture	K_U27 K_U28
6.	Is able to perform numerical calculations of simple modernizations of boiler heating surfaces	Defence of project	Project	K_W24 K_U22 K_U28
<b>18. Teaching modes and hours</b>				
<b>Lecture 15 / BA /MA Seminar / Class / Project / Laboratory 15</b>				
<b>19. Syllabus description:</b>				
<p>Ecological and economical challenges facing the power industry in Poland and in the world with emphasis on problems of CO<sub>2</sub> emission. The ways to improve efficiency of a power plant. Modernizations in the area of boiler technology: improvement of boiler efficiency and decrease of pollutant emissions. Introduction to modernization of power boiler furnaces enabling combustion of biomass and wastes and abatement of NO<sub>x</sub> emissions. Modernizations of turbines and generators. Secondary NO<sub>x</sub> abatement techniques. Improvement of flue gas precipitation. Flue gas desulphurization systems. The ways to decrease the consumption of energy for power station internal load.</p> <p><b>Laboratory:</b> Numerical modeling of a superheater stage in a power boiler</p>				
<b>20. Examination:</b> No				

**21. Primary sources:**

- [1] Prabir Basu, C. Kefa, L. Jestin, Boilers and Burners: Design and Theory. SPRINGER VERLAG GMBH, 1999.  
 [2] Pronobis M.: Unpublished appendix to lectures.  
 [3] Zevenhoven R., Kilpinen P.: Control of pollutants in flue gases and fuel gases. ISBN 951 - 22 - 5527 - 8

**22. Secondary sources:**

- [1] Pronobis M.: Modernizacja kotłów energetycznych. WNT. Warszawa 2002 (In Polish).  
 [2] Chmielniak T.: Technologie energetyczne. WNT. Warszawa 2009.  
 [3] Pawlik M., Strzelczyk F.: Elektrownie. WNT 2009

**23. Total workload required to achieve learning outcomes**

Lp.	Teaching mode :	Contact hours / Student workload hours
1	Lecture	15/20
2	Classes	/
3	Laboratory	15/30
4	Project	/
5	BA/ MA Seminar	/
6	Other	5/
	Total number of hours	35/50

**24. Total hours: 85****25. Number of ECTS credits: 3****26. Number of ECTS credits allocated for contact hours: 1****27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects): 2****26. Comments:**

Approved:

2012-12-11.....  
 (date, Instructor's signature)

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 (date , the Director of the Faculty Unit signature)