Z1-PU7	WYDANIE N1	Strona 1 z 2

(*faculty stamp*)

COURSE DESCRIPTION

1. Course title: ENERGY MANAGEMENT	**2. Course code**
3. Validity of course description: 2012/2013	
4. Level of studies: BA, BSc programme / MA,MSc programme lub **1st cycle** / 2nd cycle of higher education	
5. Mode of studies: intramural studies / extramural studies	
6. Field of study: POWER ENGINEERING	(FACULTY SYMBOL)
7. Profile of studies: GENERAL	
8. Programme: SUSTAINABLE ENERGY ENGINEERING	
9. Semester: 6	
10. Faculty teaching the course: INSTITUTE OF THERMAL TECHNOLOGY	
11. Course instructor: DR TADEUSZ KRUCZEK	
12. Course classification: COMMOM	
13. Course status: compulsory /elective	
14. Language of instruction: English	
15. Pre-requisite qualifications: Fundamentals of thermodynamics and heat transfer, fundamentals of evaluation of economic efficiency of investment undertakings	
16. Course objectives: Getting acquainted with principles of identification and mathematical modelling of energy systems and installations, rationalization of the using of energy, improvement of energy efficiencies of industrial processes, integration of the processes in terms of energy, system evaluation of energy processes.	

17. Description of learning outcomes:

Nr	Learning outcomes description	Method of assessment	Teaching methods	Learning outcomes reference code
1.	Student is able to formulate balances of substances and energy as well solve basic calculation problems for main energy devices and installation applied in industrial and energy sector	Written test Exam	Lecture Classes	K_W18 K_W19 K_U22 K_U23
2.	Is able to evaluate the quality of measurement results of parameters characterising the operation of energy devices and installations by means of coordination technology of substance and energy balances	Written test Exam	Lecture Classes	K_W18 K_W19 K_U22
3.	Is able to characterise main principles, features, merits and bad points of cogenerative production of heat and electricity, is able to calculate partial energy efficiencies of heat and electricity production and energy savings due to simultaneous production of heat and electricity, is able to characterise basic CHP systems	Written test Exam	Lecture Classes	K_W16 K_W18 K_W19 K_U22 K_U23 K_U26
4.	Student knows fundamentals of pinch technology (PT) and principles of its use for rationalization of energy processes, composite curves construction, determination of minimal requirement of delivered to and removed heat from the system, application of PT for rationalization of heat exchangers network, solving of basic calculation problems.	Written test Exam	Lecture Classes	K_W19 K_W20 K_U22 K_U26
5.	Student knows main types and sources of waste energy, methods of the evaluation of waste energy resources, potential methods of their utilization, is able to evaluate economic efficiency of energy recovery undertakings and carry out basic calculations	Written test Exam	Lecture Classes	K_W16 K_W19 K_W20 K_U22 K_U23
6.	Student is able to explain fundamentals of cumulative energy consumption and potential applications, knows methods of calculation of cumulative energy consumption indices, is able to carry out basic calculations	Written test Exam	Lecture Classes	K_W19 K_U21

18. Teaching modes and hours

Lecture 30h / BA /MA Seminar / 30h Class / Project / Laboratory

19. Syllabus description:

Lecture:
Balances of substance as the tool in industrial engineering. Compositions of solids, liquids and gas mixtures. Examples of application of balance of the substances for complex industrial processes.
Energy balances and energy analysis. Energy balances as the tool for analysis of industrial processes. Chemical and thermal (physical) enthalpy. Enthalpy of devaluation of energy and non-energy products. Energy balances for typical industrial devices.
Application of the least squares adjustment method to the coordination of substance and energy balances in energy analysis. Conditional equations, algorithm of calculations, the benefits of applying the coordination procedure, example of calculations.
Production of heat and electricity in combined plants. Principles of cogeneration. Partial energy efficiencies of heat and electricity production. Saving chemical energy of fuel due to cogenerative production of heat and electricity. Steam and gas turbine applied in energy sector. Thermodynamics cycles of combined heat and power plants. Cogeneration systems with reciprocating engines, with conversion of methane. Cheng's cogeneration plant, humid air turbine (HAT) plant. Integrated gasification combined cycle (IGCC) plant.
Pinch technology-technique for rationalization of integration of energy processes and optimization of the waste energy utilization. Fundamentals, features, main principles and aim of PT application. Composite curves construction. Determination of maximal heat recuperation, minimal requirement of delivered to and removed heat from the system. Temperature intervals, heat cascading, energy interval balances. Heat exchangers network development. Calculation examples. Waste energy utilization. Types of waste energy. Methods of waste energy utilization, installations for utilization of waste energy. Evaluation of waste energy resources. Economy of waste energy utilization and rationalization of use of energy.
Cumulative energy consumption. Fundamentals of energy economy. Potential applications of indices of cumulative energy consumption. Methods of indices calculations.
Classes:
As topics of the lectures

20. Examination: Yes

21. Primary sources:

1. Kruczek T.: Lecture notes
2. Szargut J., Ziębik A.: Fundamentals of thermal energy engineering, in Polish (Podstawy energetyki cieplnej). Wyd. PWN, Warszawa, 1998 i in.
3. Górzyński J., Urbaniec K.: Wytwarzanie i użytkowanie energii w przemyśle. Oficyna Wyd. Pol. Warszawskiej, Warszawa, 2000.
4. Szargut J., Ziębik A.: Skojarzone wytwarzanie ciepła i elektryczności-elektrociepłownie. PAN Oddział Katowice, 2007.
5. Szargut J. i in: Racjonalizacja użytkowania energii w zakładach przemysłowych. Biblioteka Fund. Posz. Energii, Warszawa, 1994

22. Secondary sources:

1. The steam and condensate loop. An engineer's best practice guide for saving energy. Wyd. Spirax Sarco Ltd., England, 2008.
2. Kreith F., Goswami Y., D. (ed): Handbook of energy efficiency and renewable energy. CRC Press Taylor & Francis Group, 2007.

23. Total workload required to achieve learning outcomes

Lp.	Teaching mode :	Contact hours / Student workload hours
1	Lecture	30/30
2	Classes	30/60
3	Laboratory	/
4	Project	/
5	BA/ MA Seminar	/
6	Other	/
	Total number of hours	60/90

24. Total hours: 150

25. Number of ECTS credits: 5

26. Number of ECTS credits allocated for contact hours: 2

27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects): 3

26. Comments:

Approved:

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(date, Instructor's signature) *(date , the Director of the Faculty Unit signature)*