Modeling of Energy systems

Faculty of	**Mechanical and Power Engineering**
Name in English	**Modeling of Energy systems**
Name in Polish	**Modelowanie systemów energetycznych**
Main field of study	**Power Engineering**
Specialization	**-**
Level of studies	**II level**
Form of studies	**full-time**
Kind of subject	**obligatory**
Subject code	**W09ENG-SM2341**
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		30		
Number of hours of total student workload (CNPS)	25		50		
Form of crediting	Zaliczenie		Zaliczenie		
For group of courses mark final course with (X)					
Number of ECTS points	1		2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BU) classes	0,68		1,36		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1.	Basic knowledge of thermodynamics, heat transfer, machine design and energy generation in power plant and CHP
2.	Basic knowledge of a chosen worksheet (eg. Excel, Mathcad)

SUBJECT OBJECTIVES

C1	Demonstrate an understanding of the fundamentals and laws governing energy conversion
C2	Discuss issues related to the performance of conventional power-generation plants.
C3	Present trends toward renewable sources of electricity.
C4	A study of steam generation and utility plants, including cogeneration, gas turbine, and combined cycles
C5	Demonstrate features of advanced power plants
C6	Perform engineering calculations.

SUBJECT LEARNING OUTCOMES

relating to knowledge:	
PEU_W01	Demonstrate a comprehensive understanding of the fundamentals and laws governing conversion of energy
PEU_W02	Perform the analysis of cogeneration, combined and integrated cycles for conventional and advanced technologies
PEU_W03	Understand the operation and major components of electricity generating and CHP plants
PEU_W04	Select the type of plant appropriate for a given application.
PEU_W05	Perform basic analyses associated with each subsystem and component of the plant.
PEU_W06	Overall picture of the applied fields for cogeneration systems

PEU_W07	Define mathematical model to assess particular energy system
relating to skills:	
PEU_U01	Perform engineering calculations encountered in practice.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Wy1	Introductory lecture. Energy and electricity fundamentals. Terminology. Numerical Steam Tables.	1
Wy2	Steam power plants. Thermodynamic principles. Fuels. Steam power generation cycles. Nuclear Power Plant	2
Wy3	Steam power plants. Performance improvement. Mathematical modeling.	2
Wy4	Gas turbine and combined-cycle power plants: Gas turbine engines and performance. Gas turbine cycles. Combined-cycle power plants.	2
Wy5	CHP systems: CHP schemes (micro-scale CHP systems, small scale CHP systems, large scale CHP systems including district heating schemes).	2
Wy6	Organic Rankine Cycle. Numerical Tables of different working fluids. Mathematical modelling.	2
Wy7	National Energy System	2
Wy8	Course summary	2
Suma godzin		15

laboratory		Number of hours
La1	Numerical Steam Tables in a chosen worksheet – simple examples.	2
La2	Analysis of simple conventional power plant system. Defining algorithm.	2
La3	Analysis of simple conventional power plant system. Defining algorithm. Optimization problem	2
La4	Analysis of Nuclear Power Plant steam turbine cycle. Defining algorithm.	2
La5	Analysis of Nuclear Power Plant steam turbine cycle. Defining algorithm.	2
La6	Analysis of simple and complex gas turbine energy systems.	2
La7	Analysis of simple and complex gas turbine energy systems.	2
La8	Analysis of simple and complex gas turbine energy systems.	2
La9	Basic design of energy sytems project utilizing renewable sources of energy and waste heat – numerical analysis of ORC.	2
La10	Basic design of energy sytems project utilizing renewable sources of energy and waste heat – numerical analysis of ORC	2
La11	Analysis of simple and complex energy systems – using commercial tool.	2
La12	Analysis of simple and complex energy systems – using commercial tool.	2
La13	Simple National Energy System Simulator	2
La14	Analysis of monitoring and diagnostic systems data. – processing and analysis of DCS power plant unit system in Excel and MathCad	2
La15	Final test	2
Suma godzin		30

TEACHING TOOLS USED	
N1	Lecturing with multimedia - computer presentation
N2	Calculation worksheets MathCad, scrypt language Python Excel and engineering tool CYCLE-TEMPO, Ebsilon
N3	Case studies
N4	Discussion and consultancy.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEU_U01	Activity, final test
P1	PEU_W01÷PEK_W07	Final test

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	M. M. El-Wakil, Powerplant Technology, McGraw-Hill, 1984 or 2002.
2	Culp, Principles of Energy Conversion, 2nd Edition, 1991.
3	Weisman & Eckart, Modern Power Plant Engineering, 1985
4	Combined-Cycle Gas & Steam Turbine Power Plants. Kehlhofer, R..ISBN 0-88173-076-9
Secondary literaturę	
1	Nye, David E. Consuming Power: A Social History of American Energies. The MIT Press: Cambridge, MA, 1999

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

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