Course name:

DESIGN AND OPERATION OF RENEWABLE ENERGY ENGINEERING SYSTEMS

ECTS	**7**
Course status	**obligatory**
Course final assessement/evaluation of outcomes	**exam**
Prerequisites	

Main field of study:

Renewable Energy Sources and Waste Management

Profile of study	**General-academic**
The code of studies (education level)	**SM (master)**
Semester of studies	**summer / winter**
Language of instruction	**English**

Course offered by:

Name of faculty offering the course	**Faculty of Production and Power Engineering**
Name of department offering the course	**Department of Bioprocesses Engineering, Energetics and Automatization**
Course coordinator	**Hubert Latała, assoc. prof.**

Learning outcomes of the course:

Symbol of outcome	Description of learning outcome	Reference to	
		main field of study outcomes	discipline#
KNOWLEDGE – student knows and/or understands:			
PEO_W1	advanced methods of solving engineering tasks related to the operation of equipment, installations and facilities for obtaining energy from renewable sources and waste management	OZE2_W06	TZ
PEO_W2	methods for life cycle assessment of the equipment, facilities and technical systems used for waste management	OZE2_W09	TZ, TS
PEO_W3	advanced methods, techniques, technologies applied in solving simple engineering tasks which allow to use and shape the nature potential in the field of renewable energy sources and waste management	OZE2_W11	TZ, TS
SKILLS – student is able to:			
PEO_U1	independently plan and perform experiments, take measurements, interpret the results obtained and draw conclusions	OZE2_U10	TZ
PEO_U2	evaluate the operation of mechanical system components, conduct a diagnostic experiment allowing to assess the correctness of the system operation	OZE2_U12	TZ

PEO_U3	assess the advantages and disadvantages of the engineering activities undertaken, including their originality	OZE2_U15	TZ
PEO_U4	assess suitability, select and apply appropriate methods and tools for solving engineering tasks (including complex tasks) that are characteristic of the field of renewable energy sources and waste management	OZE2_U16	TZ, TS
PEO_U5	design a simple or complex process typical of the field of renewable energy sources and waste management using the right techniques and tools	OZE2_U19	TZ

SOCIAL COMPETENCE- student is ready to:

PEO_K1	take responsibility for decisions and effects of engineering activities undertaken	OZE2_K01	TZ
PEO_K2	take conscious, social, professional and ethical responsibility for the condition of natural environment (is aware of the risk and can assess effects of entrepreneurial activity)	OZE2_K06	TZ

Teaching contents:

Lectures		**20**	**hours**
Topics of the lectures	Solar energy - the possibility of its processing, the efficiency of use Biogas - technologies of acquisition and purification, management of energy streams Deep geothermy, resources, possibilities of obtaining energy Heat exchangers and buffer tanks Water energy, small and large hydropower Wind energy, technical solutions - efficiency Legal conditions in the field of renewable energy		
Accomplished learning outcomes	*PEO_W1, PEO_W2, PEO_W3, PEO_K1, PEO_K2*		
Verification methods, rules and criteria of outcome assessment	*Test (50%)*		

Classes		**50**	**hours**
Topics of the classes	Project of combined energy management in the selected facility Legal conditions in the field of renewable energy sources - project Gasification of biomass Efficiency of devices in water energy Innovative technical solutions in the field of heat pumps Associated energy management		
Accomplished learning outcomes	PEO_U3, PEO_U4, PEO_U5, PEO_K1, PEO_K2		
Verification methods, rules and criteria of outcome assessment	*Preparation of projects, Reports from laboratory exercises (50%)*		

References:

Basic	*1. Miguel A. Sanz-Bobi. 2014. Use, Operation and Maintenance of Renewable Energy Systems. Experiences and Future Approaches. Springer International Publishing Switzerland 2014. DOI: https://doi.org/10.1007/978-3-319-03224-5.* *2. Sabyasachi SenGupta, Ahmed F. Zobaa, Karma Sonam Sherpa, Akash Kumar Bhoi. 2018. Advances in Smart Grid and Renewable Energy. Springer Nature Singapore Pte Ltd. DOI: https://doi.org/10.1007/978-981-10-4286-7.*
Supplementary	*1. Latała Hubert, Nęcka Krzysztof, Kurpaska Sławomir, Karbowniczak Anna: Theoretical and Real Efficiency of Monocrystalline PV Modules in a 2-Year Cycle, w: Infrastructure and Environment /Krakowiak-Bal Anna, Vaverkova Magdalena (red.), 2019, Springer, ISBN 978-3-030-16541-3, ss. 339-344, DOI:10.1007/978-3-030-16542-0_42.* *2. Latała Hubert, Kurpaska Sławomir, Kwaśniewski Dariusz: Theoretical and real efficiency of nonsilicon PV modules in a 3-year cycle, w: 2019 Applications of Electromagnetics in Modern Engineering and Medicine (PTZE) / Korzeniewska Ewa (red.), 2019, Institute of Electrical and Electronics Engineers, ISBN 978-83-88131-00-4, ss. 93-96, DOI:10.23919/PTZE.2019.8781734* *3. Sławomir Kurpaska, Jarosław Knaga, Hubert Latała, Michał Cupiał, Paweł Konopacki, Ryszard Hołownicki. The Comparison of Different Types of Heat Accumulators and Benefits of Their Use in Horticulture. Sensors 2020, 20, 1417; doi:10.3390/s20051417*

Structure of learning outcomes:

Discipline: mechanical engineering # (*TZ*)				5,5	ECTS*
Discipline:TS				1,5	ECTS*
Structure of student activities:					
Contact hours		85	hours	3,4	ECTS**
including:	lectures	20	hours		
	classes and seminars	50	hours		
	consultations	10	hours		
	participation in research	…	hours		
	mandatory trainerships	…	hours		
	participation in examinations	5	hours		
e-learning		…	hours	…	ECTS**
student own work		90	hours	3,6	ECTS**

*** where 10 hours of classes = 1 ECTC (in case of 15 h → 2 ECTS)**

** stated with an accuracy to 0.1 ECTS, where 1 ECTS = 25 - 30 hours of classes

academic discipline code: RZ - animal science and fishery, PB - biological sciences, etc.