



MODULE SPECIFICATION

Module code	
Module title in Polish	Niekonwencjonalne systemy ciepłne
Module title in English	Non-standard heating systems
Module running from the academic year	2016/2017

A. MODULE IN THE CONTEXT OF THE PROGRAMME OF STUDY

Field of study	Environmental Engineering
Level of qualification	first cycle (first cycle, second cycle)
Programme type	academic (academic/practical)
Mode of study	full-time (full-time/part-time)
Specialism	Sanitary Pipelines and Systems
Organisational unit responsible for module delivery	Department of Piped Utility Systems
Module co-ordinator	Tadeusz Orzechowski, PhD hab., Eng., Professor of the University
Approved by:	Prof. Andrzej Kuliczowski, PhD hab., Eng.

B. MODULE OVERVIEW

Module type	programme-specific module (core/programme-specific/elective HES*)
Module status	optional module (compulsory/optional)
Language of module delivery	Polish/English
Semester in the programme of study in which the module is taught	semester 6
Semester in the academic year in which the module is taught	summer semester (winter semester/summer semester)
Pre-requisites	None (module code/module title, where appropriate)
Examination required	No (Yes/No)
ECTS credits	1

* elective HES – elective modules in the Humanities and Economic and Social Sciences

Mode of instruction	lectures	classes	laboratories	project	others
Total hours per semester	15				



C. LEARNING OUTCOMES AND ASSESSMENT METHODS

Module aims	The aim of the module is to learn the practical replacement options of conventional energy source with the renewable ones. Moreover, the presentation of selected solutions with heat pumps and solar collector installations.
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Module outcome code	Module learning outcomes	Mode of instruction (l/c/lab/p/ others)	Corresponding programme outcome code	Corresponding discipline-specific outcome code
W_01	A student knows the heat production techniques in case of heating systems and warm water for use installations.	l	IŚ_W10	T1A_W04 T1A_W05 T1A_W06 T1A_W07
W_02	A student knows the low-temperature heat sources and techniques of its extraction.	l	IŚ_W10	T1A_W04 T1A_W05 T1A_W06 T1A_W07
W_03	A student knows the types, the principle of action and component parts of heat pumps and solar system.	l	IŚ_W10	T1A_W04 T1A_W05 T1A_W06 T1A_W07
U_01	A student can design a heating system equipped with the heat pump.	l	IŚ_U19	T1A_U03 T1A_U05 T1A_U07 T1A_U08 T1A_U09 T1A_U10 T1A_U11 T1A_U13 T1A_U14 T1A_U15 T1A_U16
U_02	A student can prepare a conceptual design of solar system.	l	IŚ_U19	T1A_U03 T1A_U05 T1A_U07 T1A_U08 T1A_U09 T1A_U10 T1A_U11 T1A_U13 T1A_U14 T1A_U15 T1A_U16
K_01	A student can formulate conclusions and describe the results of the obtained work.	l	IŚ_K07	T1A_K07

Module content:

1. Topics to be covered in the lectures

No.	Topics	Module outcome code
1.	Heat production in case of heating and warm water for use needs.	W_01
2.	Low-temperature heat sources and techniques of its extraction.	W_02
3.	Heat pumps: types, the principle of action and component parts.	W_03
4.	Engineering design of heating installations with heat pump.	W_03 U_01
5.	Solar systems: possible solutions and applications.	W_03 U_02



6.	Design solutions of solar and heat pump installations.	W_03 U_02 K_01
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Assessment methods

Module outcome code	Assessment methods <i>(Method of assessment; for module skills – reference to specific project, laboratory and similar tasks)</i>
W_01	A test
W_02	A test
W_03	A test
U_01	A test
U_02	A test
K_01	A test

D. STUDENT LEARNING ACTIVITIES

ECTS summary		
	Type of learning activity	Study time/ credits
1	Contact hours: participation in lectures	15
2	Contact hours: participation in classes	
3	Contact hours: participation in laboratories	
4	Contact hours: attendance at office hours (2-3 appointments per semester)	5
5	Contact hours: participation in project-based classes	
6	Contact hours: meetings with a project module leader	
7	Contact hours: attendance at an examination	
8		
9	Number of contact hours	20 <i>(total)</i>
10	Number of ECTS credits for contact hours <i>(1 ECTS credit = 25-30 hours of study time)</i>	0.8
11	Private study hours: background reading for lectures	3
12	Private study hours: preparation for classes	2
13	Private study hours: preparation for tests	
14	Private study hours: preparation for laboratories	
15	Private study hours: writing reports	
16	Private study hours: preparation for a final test in laboratories	
17	Private study hours: preparation of a project/a design specification	
18	Private study hours: preparation for an examination	
19		
20	Number of private study hours	5 <i>(total)</i>
21	Number of ECTS credits for private study hours <i>(1 ECTS credit = 25-30 hours of study time)</i>	0.2



22	Total study time	25
23	Total ECTS credits for the module <i>(1 ECTS credit =25-30 hours of study time)</i>	1
24	Number of practice-based hours <i>Total practice-based hours</i>	
25	Number of ECTS credits for practice-based hours <i>(1 ECTS credit =25-30 hours of study time)</i>	

E. READING LIST

References	<ol style="list-style-type: none">1. Heat recovery systems & CHP: Combined heat and power, Oxford: Pergamon Press, 1987-19552. Babiarez Bożena, Heating system designing, Rzeszów: Oficyna Wydawnicza Politechniki Rzeszowskiej, 20153. Chiasson Andrew, Geothermal heat pump and heat engine systems: theory and practice, ASME Press; Wiley, 20164. Karl W. Boer and John A. Duffie, Advances in solar energy: an annual review of research and development. Vol. 1, New York: American Solar Energy Society, Inc., 1982
Module website	https://www.epa.gov/rhc/renewable-hot-water-heating http://www.ure.gov.pl/en/energy-in-poland/25,Heat.html www.byg.dtu.dk/-/media/Institutter/Byg/publikationer/PhD/byg-r296.ashx?la=da