



Subject card

Subject name and code		Geothermal energy and heat pumps, PG_00055942						
Field of study		Power Engineering						
Date of commencement of studies		October 2026	Academic year of realisation of subject			2028/2029		
Education level		first-cycle studies	Subject group			Optional subject group Subject group related to scientific research in the field of study		
Mode of study		Full-time studies	Mode of delivery			at the university		
Year of study		3	Language of instruction			Polish		
Semester of study		6	ECTS credits			4.0		
Learning profile		general academic profile	Assessment form			assessment		
Conducting unit		Institute of Energy -> Faculty of Mechanical Engineering and Ship Technology -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)		Subject supervisor	dr hab. inż. Jan Wajs					
		Teachers						
Lesson types		Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
		Number of study hours	30.0	0.0	0.0	15.0	0.0	45
		E-learning hours included: 0.0						
Learning activity and number of study hours		Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours		Self-study	SUM	
		Number of study hours	45	6.0		49.0	100	
Subject objectives		Discussion on the power engineering technology applied to the energy from geothermal resources. Discussion of theoretical fundamentals, constructions and applications of heat pumps. Presentation of designing principles of heating installations with heat pumps.						
Learning outcomes		Course outcome	Subject outcome		Method of verification			
		[K6_W10] knows the basic installations in the field of renewable energy sources and their impact on the environment	Student has knowledge about the operation of energy equipment for geothermal technologies.		[SW1] Assessment of factual knowledge			
		[K6_W06] knows classic and developmental energy technologies, rules for the selection and operation of heat and energy devices and installations, basic principles of energy systems operation, basic issues regarding the reliability of energy devices and diagnostics, environmental effects of energy technologies used, methods of using renewable energy sources	Student possesses knowledge of systems with heat pumps. Student possesses knowledge of devices diagnostics in the compressor heat pump cycle. He/She is able to evaluate an influence of heat pump working fluid on the environment		[SW1] Assessment of factual knowledge			
		[K6_U04] is able to design a simple device structure and prepare the accompanying technical documentation, conduct a basic technical and economic analysis of energy systems, including technologies using renewable and pro-ecological energy sources as well as conventional and nuclear energy, design energy installations for them and their basic elements (including electric lighting)); select, operate and control the most commonly used electrical devices and drive systems.	Student is able to perform a project with thermodynamic and economic calculations of the geothermal energy conversion system.		[SU4] Assessment of ability to use methods and tools			

Subject contents	<p>Course content – lecture LECTURE: Origin of geothermal energy, its characteristics and place in Europe and in the World, the basic concepts of geothermal energy. Selection of geothermal energy in Poland. Shallow geothermal energy and its use in heating. Systems supported by geothermal energy and geothermal energy. Principles of operation of compressor heat pumps. Construction of compressor heat pumps. Heat sources of low temperature for installation with heat pump. Heat source of high temperature in the system with heat pump. Working fluids aspects of thermodynamic properties and environmental impact. High temperature compressor heat pump. Introduction to a designing of heating installations with compressor heat pump.</p> <p>Project: Guidelines of heat source selection in dependence on installation/building type. Selection of main components and safety devices. Creation of technological schemes of heat centres with heat pumps.</p>											
Prerequisites and co-requisites	Knowledge from course of Applied thermodynamics and Heat transfer.											
Assessment methods and criteria	<table border="1" data-bbox="448 495 1487 595"> <thead> <tr> <th data-bbox="448 495 794 528">Subject passing criteria</th> <th data-bbox="794 495 1141 528">Passing threshold</th> <th data-bbox="1141 495 1487 528">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="448 528 794 562">written assessment of the lecture</td> <td data-bbox="794 528 1141 562">56.0%</td> <td data-bbox="1141 528 1487 562">60.0%</td> </tr> <tr> <td data-bbox="448 562 794 595">project</td> <td data-bbox="794 562 1141 595">56.0%</td> <td data-bbox="1141 562 1487 595">40.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	written assessment of the lecture	56.0%	60.0%	project	56.0%	40.0%
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Recommended reading	<p>Basic literature</p> <p>Supplementary literature</p> <p>eResources addresses</p>	<p>1. Stober I., Bucher K.: Geothermal energy - from theoretical models to exploration and development. Springer, Berlin, 2013.</p> <p>2. Nowak T.: Heat pumps. Integrating technologies to decarbonise heating and cooling, European Copper Institute, 2018.</p> <p>3. Grassi W.: <i>Heat pumps. Fundamentals and Applications</i>, Springer International Publishing, 2018.</p> <p>no requirements</p>										
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> 1. The term of geothermal energy. 2. Provide classification of heat pumps. 3. Discuss operational principles of compressor heat pumps. 4. Provide information about applications of heat pumps in geothermal systems. 											
Practical activities within the subject	Not applicable											

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