



Subject card

Subject name and code	Heat infrastructure development, PG_00055977						
Field of study	Power Engineering, Power Engineering, Power Engineering						
Date of commencement of studies	October 2023	Academic year of realisation of subject				2025/2026	
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				exam	
Conducting unit	Department of Sanitary Engineering -> Faculty of Civil and Environmental Engineering -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Ewa Zaborowska				
	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	The course aims to provide basic knowledge of heating substations and networks, their operating principles, installation materials and selection criteria, design methods and tools supporting the design process, and methods and technologies for constructing these installations. The course will lead to the acquisition of basic skills in the application of calculation methodology and principles of heating infrastructure design.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[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	Knows the principles of selection and operation of devices and installations related to heating infrastructure (substations, networks) and the principles of operation of these systems	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
	[K6_W12] has basic knowledge of the life cycle and repairs of energy equipment in the field of thermal power stations, thermal and energy systems and heating systems, internal combustion engines and compressors as well as rotating machines	Has basic knowledge of operational degradation, potential failures and diagnostics of heating infrastructure elements	[SW1] Assessment of factual knowledge
	[K6_U13] can read architectural, construction and geodesy drawings, and can use the known computer software to prepare a drawing part of technical documentation for the sanitary, energy, hydropower industry and prepare a text or presentation including a discussion of the implemented results	Is able to use software supporting the design of heating infrastructure and prepare the relevant technical documentation	[SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task
	[K6_U14] can use properly selected methods and devices for hydraulics and hydrology, enabling determination of basic parameters characterizing the flow of medium in channels, pipelines and flow objects and can design installations, networks in the field of sanitary engineering	Is able to use appropriately selected methods to determine the basic parameters characterizing the flow of the medium in pipelines, is able to design elements of installations related to the heating infrastructure	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
	[K6_W09] knows the dangers of electrical devices and the principles of protection against them, has basic knowledge of heat exchangers, has basic knowledge of power equipment such as pumps, compressors, turbines, combustion engines, boilers, pipelines and their accessories and methods of their selection depending on the needs	Has basic knowledge of heat exchangers, pumps, pipelines and fittings as well as methods for their selection within the heating infrastructure	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
Subject contents	Course content – lecture		
	<p>Classification of heating substations. Heat transfer and heat exchangers. Functional modules, fittings, devices, pipelines, and automatic regulation of heating substations. Protection against excessive pressure increases, secondary contamination of tap water, and microbiological hazards. Filling and refilling systems. Heating substation rooms. Technical requirements and acceptance tests.</p> <p>Classification and basic characteristics of various heating network systems. Materials, components, and fittings of pre-insulated systems. Network condition diagnostics - fault detection and alarm systems. Basic design principles and methods for laying pre-insulated pipelines in the ground. Stresses, elongations, compensations, fictitious and real fixed points. Installation principles, joint assemblies. Technical requirements and acceptance tests.</p>		
Prerequisites and co-requisites	Course content – project		
	<p>Design of a heating substation connected to a high-temperature water heating network. Schematic diagram, hydraulic calculations for the primary and secondary circuits, selection of equipment and fittings. Design of a section of a pre-insulated underground heating system/network. Calculation of stresses and elongations, determination of pipeline geometry, the location of fixed points, and the size of compensation zones.</p>		
Assessment methods and criteria	Knowledge of the basics of thermodynamics and hydraulics		
	Subject passing criteria	Passing threshold	Percentage of the final grade
	Project	50.0%	50.0%
Written exam	50.0%	50.0%	

Recommended reading	Basic literature	<ol style="list-style-type: none"> 1. Applicable legal regulations and Polish Standards related to the topic. 2. Zaborowska E.: Zasady projektowania wodnych węzłów ciepłowniczych. Wydawnictwo PG, Gdańsk 2010 lub późn. 3. Catalog cards and design and installation guides for pre-insulated systems from various manufacturers, e.g., np. ZPU Międzyrzecz, Alstom Power, Finpol Rohr, Isoplus, Prim Lublin i in. 4. Information materials and guidelines from equipment and fittings manufacturers. 5. Technical requirements for construction and acceptance by COBRTI INSTAL and PZiTS.
	Supplementary literature	<ol style="list-style-type: none"> 1. Żarski K.: Węzły ciepne w miejskich systemach ciepłowniczych. Poradnik. Wyd. 2. Wydawnictwo Instal, Warszawa 2014. 2. Żarski K.: Projektowanie preizolowanych sieci ciepłych w technologii ABB Zamech, ABB Zamech, Toruń 1994. 3. Randlov. P.: Podręcznik ciepłownictwa system rur preizolowanych. European District Heating Pipe Manufactures Association, Fredericia, Dania 1998. 4. Technical journals (GWTS, COW, Instal, Rynek Instalacyjny, etc.).
	eResources addresses	
Example issues/ example questions/ tasks being completed	<p>Design of a high-temperature heating substation for a selected building (e.g., residential, collective housing, or public utility building).</p> <p>Design of a pre-insulated underground heating installation/network (connection to a building or instalation/network supplying multiple buildings).</p>	
Practical activites within the subject	Not applicable	

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