GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Heating, ventilation, and air conditioning, PG_00055495						
Field of study	Mechanical Engineering						
Date of commencement of studies	October 2022		Academic year of realisation of subject	2024/2025			
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	5		ECTS credits	9.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Institute of Energy -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Marcin Jewartowski				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	60.0	15.0	30.0	15.0	0.0	120
	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	120		11.0	94.0		225
Subject objectives	Students acquire basic knowledge in the field of of heating, refrigeration, ventilation and air conditioning in theoretical and practical aspects.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_U06] is able to use mathematical and physical models for analysing the processes and phenomena occurring in mechanical devices within the range of material strength, thermodynamics and fluid mechanics	The student is able to calculate the elements of heating, refrigeration, ventilation and air conditioning systems using the guidelines contained in standards and regulations.	[SU3] Assessment of ability to use knowledge gained from the subject
	[K6_U03] is able to identify, formulate and develop the documentation of a simple design or technological task, including the description of the results of this task in Polish or in a foreign language and to present the results using computer software or other aiding tools	Student is able to calculate the thermal load of buildings and design simple heating installations with the use of auxiliary software as well as present obtain results.	[SU5] Assessment of ability to present the results of task [SU1] Assessment of task fulfilment
	[K6_W09] possesses basic knowledge within the range of thermodynamics and fluid mechanics, construction and operation of heat generating devices, process equipment, including renewable energy sources, cooling and air conditioning	The student is able to characterize heating, refrigeration, ventilation and air conditioning systems, their components and functioning.	[SW1] Assessment of factual knowledge
	[K6_W11] possesses knowledge on design, technology and manufacturing of machine parts, metrology, and quality control; knows and understands methods of measuring and calculating basic values describing the operation of mechanical systems, knows basic calculating methods applied to analyse the results of experiments	The student is able to measure and calculate the elements of heating, refrigeration, ventilation and air conditioning systems and to analyze the results.	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
	[K6_U07] is able to design a typical construction of a mechanical device, component or a testing station using appropriate methods and tools, adhering to the set usage criteria	Student is able to calculate the thermal load of buildings and design simple heating installations with the use of auxiliary software.	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment
Subject contents	LECTURE: Basic concepts and regulations regarding heating and district heating. Heat sources in heating. Heat distribution networks and district heating substations. Designed heat load of buildings. Central heating systems. Guidelines for design and calculations of central heating systems. Hydraulic control. Heating pipes and their thermal insulation. Pressure losses in the pipes. Radiators. Hot tap water systems. Passive buildings. Application of refrigeration units and heat pumps. Design and working principles of a compressor refrigeration plant. Direct and indirect cooling systems. Refrigerants and heat carriers: selected properties. Interaction of basic elements in cooling systems. Selected operational problems in refrigeration. Ventilation systems in buildings. Ventilation systems of industrial spaces. Methods of calculating supply and exhaust streams. Designing ducts. Equipment selection. The aim and application of air conditioning. Comfort and industrial air conditioning. Moist air - characteristics, Mollier chart. Calculation of the thermal load of objects - heat gains and losses. The necessary amount of supply air (including fresh air). Examples of air conditioning systems solutions. Recovery systems demands in air conditioning systems. The problems of systems operation. TUTORIALS: Moist air - characteristics, Mollier chart. Calculation of the thermal load of objects - heat gains and losses. The necessary amount of supply air (including fresh air). Calculation of supply and exhaust streams. Designing ducts. LABORATORY: District heating substations. Heat sources (water boiler, solar collector). Radiators. Calculations of designed heat load using commercial software. Influence of changes in the operating parameters of a cooling device on the characteristic values. The influence of the system configuration on the work efficiency. Operation of various elements of refrigeration automation. PROJECT: Design of central heating installation for a selected building		
Prerequisites and co-requisites	Knowledge from the course of Thermodynamics		

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Lecture: written test	56.0%	60.0%
	Tutorials: written test	56.0%	10.0%
	Laboratory: attendance and reports	100.0%	20.0%
	Project: preparation of the project	100.0%	10.0%
Recommended reading	Basic literature	• Pr. zbiorowa pod red. H.Koczyk Ogrzewnictwo Praktyczne, Systherm, Poznań, 2009 • Pieńkowski K., Krawczyk D., Tumel W., Ogrzewnictwo. Politechnika Białostocka, Białystok, 1999 • Recknagel, Sprenger, Schramek, Kompendium ogrzewnictwa i klimatyzacji. Omni Scala, Wrocław, 2008 • Bonca Z., Chłodnictwo okrętowe. Wyd. Akademii Morskiej w Gdyni, 2006 • Bonca Z. i in., Nowe czynniki chłodnicze i nośniki ciepła. Właściwości cieplne, chemiczne i eksploatacyjne. Poradnik. Wyd. MASTA, Gdańsk, 2004 • Ullrich H.J., Technika chłodnicza. Poradnik. Tom I, Wyd. MASTA,Gdańsk, 1998 • Jaskólski M., Micewicz Z.- Wentylacja i klimatyzacja hal krytych pływalni. IPPU MASTA, Gdańsk, PG • Szymański T., Wasiluk W., Systemy wentylacji przemysłowej. Skrypt PG	
	Supplementary literature	• standards and regulations for calculating the design heat load and energy performance of buildings	
	eResources addresses		
Example issues/ example questions/ tasks being completed	Present the classification of central heating systems. Present the classification of district heating substations. Characterize the pressure losses in pipes.		
Work placement	Not applicable		