GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Heating and cooling systems in buildings, PG_00057354		
Field of study	Power Engineering		
Date of commencement of studies	February 2024	Academic year of realisation of subject	2024/2025
Education level	second-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	1	Language of instruction	Polish
Semester of study	2	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Sanitary Engineering -> Faculty of Civil and Environmental Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	mgr inż. Krzysztof Kaiser	
	Teachers		

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	15.0	0.0	30
	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	30	8.0	37.0	75

Subject objectives	The aim of the course is to familiarize with the basic theoretical issues and practical problems related to heating and cooling systems in buildings, including ventilation and air conditioning systems, current legal regulations and standards related to the subject.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_K03] is able to think and act creatively and entrepreneurially, is aware of the responsibility for his/ her own work and takes responsibility for teamwork	The student is able to describe in an analytical and synthetic way the issues related to the matters of heating and cooling systems. Student is aware of the work performed by a multi-discipline design team.	[SK1] Assessment of group work skills [SK3] Assessment of ability to organize work [SK4] Assessment of communication skills, including language correctness
	[K7_W10] knows the basic installations of advanced energy systems, transmission networks and internal installations and their impact on the environment	The student uses the terms and specialized language thermodynamics and ventilation and air conditioning and uses ventilation knowledge and building air conditioning. Student can prepare documentation design in the field of energy systems, transmission networks and heating installations, including technical description, calculations and drawings. The student is able to determine the impact of heating and cooling infrastructure on the environment.	[SW3] Assessment of knowledge contained in written work and projects
	[K7_W02] has extended and deepened knowledge of physics, chemistry, thermodynamics, fluid mechanics, material science, necessary to understand and describe basic thermal and flow phenomena occurring in and around power equipment and systems, transmission networks and internal installations	The student uses the terms and specialist language in the field of physics, chemistry, thermodynamics, fluid mechanics and materials science and is able to use knowledge in the field of heating and cooling systems in buildings. Student knows the parameters of the external environment, basic climatic data, the diversity of climatic zones. Student knows the internal environment of buildings, thermal comfort conditions and hygienic requirements.	[SW1] Assessment of factual knowledge

Subject contents	1. External environment, parameters of the external environment, basic climatic data, differentiation of climatic zones in Poland and Europe. 2. The building's internal environment, thermal comfort conditions, hygienic requirements. 3. The building: construction of the basic structural elements of the building: foundations, walls, floors on the ground, ceilings, flat roofs, roofs, windows and doors. 4. The building: heat exchange with the environment, two-way (winter/summer) heat flow through solid and transparent partitions, heat flux attenuation in the partition, time delay, thermal mass, thermal bridges, windows, shading. 5. The building: heat balance of the building (balance of heat losses and gains, discussion of components and their dependencies, air infiltration), calculation and seasonal conditions, peak and seasonal heat demand for heating and cooling. 6. Heat and cold losses within distribution and storage. 7. Water heating and cooling installations, installation components, heat and cold receivers, duct installation, heating and cooling agents, installation protection, pump systems, division into control zones, heating circuits, installation tests, hydraulic diagrams. Discussion on types and principles of selection, design and installation. 8. Sources of heat and cold. Configuration of combined heat and cold sources. Simulation methods. Designing and installing. 9. Control automation. 10. Choosing the optimal strategy for building heating and cooling. Operating costs and capital expenditures. 11. Overview of tools (software) for designing heating and cooling systems. 12. Legal regulations in the design, construction and commissioning of heating and cooling systems. 13. Design documentation of the design phase, construction design / technical design. Building permit / notification of construction works. Acceptance and technical take-over of works. 14. Operation of heating and cooling systems. Manuals, service and maintenance.
Prerequisites and co-requisites	Knowledge of the basics of thermodynamics, fluid mechanics, mechanical ventilation. Ability to draw in CAD software. Knowledge of the subject: Heating, ventilation and air-conditioning and Household ventilation and air-conditioning systems.
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
	60.0%	50.0%
	60.0%	50.0%

Recommended reading	Basic literature	1. Refrigeration and air cooling (in Polish: Chłodnictwo i klimatyzacja). Kazimierz Gutkowski, Dariusz Butrymowicz, Kamil Śmierciew, Jerzy Gagan. Wydawnictwo naukowe PWN, edition 4, 2020. 2. Ventilation and air conditioning. Legal requirements, design, operation (in Polish: Wentylacja i klimatyzacja. Wymagania prawne, projektowanie, eksploatacja). Krzysztof Kaiser, 2015. 3. Heating. Ventilation. Air cooling (in Polish: Ogrzewnictwo. Wentylacja. Klimatyzacja). Jerzy Sewerynik, Krystyna Krygier, Tomasz Klinke, 2007. Wydawnictwa szkolne i pedagogiczne.
	Supplementary literature	1. Building physics : heat, ventilation, moisture, light, sound, fire, and urban microclimate. Saso Medved, Springer 2022.
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	