GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Heat transfer, PG_00055892		
Field of study	Power Engineering, Power Engineering, Power Engineering		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2023/2024
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study 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	2	Language of instruction	Polish
Semester of study	4	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Energy and Industrial Apparatus -> Faculty of Mechanical Engineering and Ship Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Blanka Jakubowska	
	Teachers	dr inż. Blanka Jakubowska dr inż. Stanisław Głuch dr hab. inż. Michał Klugmann dr inż. Paweł Szymański	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	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	2.0	18.0	50

Subject objectives	To familiarize students with the main mechanisms and laws of heat transfer, including conduction, convection and heat radiation.To familiarize students with methods of solving issues related to conduction, convection and radiation of heat, important in a technical context.Familiarization with basic tools enabling calculation of the efficiency and characteristics of heat exchangers.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[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	The student can design heat exchangers used in the energy sector (e.g. thermal power plants, internal combustion engines, systems compressor cooling and more rotating machines) or select individual elements of it devices . He can describe appropriate equations basic processes in them taking place. The student can use the thermal analogy electricity to solve practical issues in the field heat exchange.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
[K6_W15] knows and understands the basic quantities characteristic methods for thermodynamics, fluid mechanics and hydraulics, hydrology; knows the calculation methods and IT tools necessary to analyse the results of laboratory and field work	The student is able to independently carry out experimental methodology in the field of measurement of basic physical quantities necessary for the experimental determination of the heat conduction and heat transfer coefficient and heat fluxes transferred by convection, conduction and radiation. He can also use simple engineering software to support the calculation process in terms of basic parameters and measurement uncertainty analysis.	[SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects [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.	The student can carry out technical and economic analysis for simple structures heat exchangers. Student can apply the appropriate calculation methods for solving simpe technical issues reletaed to heat transfer. The student can design heat exchangers used in the energy sector or choose individual ones components of this device. Can describe with appropriate equations basic processes in them taking place	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task

Subject contents

Lecture:1. Conduction2. Convection3. Common4. Heat exchangers5. Methods of heat transfer intensificationLabolatory:1. Determination of the thermal conductivity coefficient of bulk bodies2. Determination of the radiative heat transfer coefficient3. Visualization of convective flow using liquid crystal techniques4. Testing the heat exchanger5. Visualization of two-phase flow

Prerequisites and co-requisites

maths, physics, fluid mechanics

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Laboratory classes	60.0%	40.0%
Written exam	60.0%	60.0%

Recommended reading

Basic literature

1. Pudlik W.: Wymiana i wymienniki ciepła, Gdańsk 1976

2. Wiśniewski S, Wiśniewski T.: Wymiana ciepła, Wydawnictwo WNT, wyd. 6, 2017

	Supplementary literature	1.Bergman T.L., Lavine A.S., Incropera F.P., Dewitt D.P.: Fundamentals of heat and mass transfer, J. Wiley&Sons, 2011 2.Bird R.B., Stewart W.E., Lightfoot E.N.: Transport phenomena, John Wiley&Sons, 1960 3.Kreith F., Manglik R.M., Bohn M.S., Tiwari S.: Principles of heat transfer, Cengage Learning, 2011 4.Serth R.W., Lestina T.G.: Process heat transfer, Elsevier, 2014
	eResources addresses	Adresy na platformie eNauczanie: Wymiana ciepła, L, E, sem.4, letni 23/24 - Moodle ID: 36446 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=36446 Wymiana ciepła, W, E, sem.4, letni 23/24 - Moodle ID: 36443 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=36443
Example issues/ example questions/ tasks being completed	1. Explain the difference between heat conduction, convection and radiation.2. Discuss the principle of operation of a heat exchanger. What are the main types of heat exchangers and in what applications are they used?3. What factors influence the efficiency of a heat exchanger? Discuss design strategies that can be used to improve exchanger performance.4. Present the heat conduction equation and discuss its importance in the analysis of heat transfer processes. What are the boundary conditions that must be considered when solving the heat conduction equation?5. Discuss the phenomenon of natural convection and forced convection. What factors influence the speed of heat flow in both types of convection?6. Discuss methods of intensifying heat transfer.	
Work placement	Not applicable	

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