GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Selected problems of heat and mass transfer, PG_00059161		
Field of study	Power Engineering, Power Engineering, Power Engineering		
Date of commencement of studies	February 2022	Academic year of realisation of subject	2022/2023
Education level	second-cycle studies	Subject group	
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	Zakład Ekoinżynierii i Silników Spalinowych -> Institute of Energy -> Faculty of Mechanical Engineering and Ship Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Janusz Cieśliński	
	Teachers	prof. dr hab. inż. Janusz Cieśliński dr inż. Paweł Dąbrowski mgr inż. Kamil Stasiak	

Lesson types and methods of instruction

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

Wybrane zagadnienia transportu ciepła i masy - Moodle ID: 25218
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=25218

Wybrane zagadnienia transportu ciepła i masy, P, E, sem.02, zimowy 22/23 (PG_00059161) - Moodle ID: 27128
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=27128

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	0.0	0.0	45

Subject objectives

The main objectives of the course are:

1. presentation of practical aspects of the use of heat transfer theory as applied to the design of heat exchangers;

2. presentation of fabrication methods, thermophysical properties and application possibilities of new working media, especially ionic liquids and nanofluids;

3. introduction to the theory of mass transfer with particular emphasis on the similarity of heat and mass transfer.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W07] knows the environmental effects of energy technologies used; is familiar with the issues of effective energy management and use of renewable energy sources, has a broad and well-established knowledge of the processes of energy production and use	Student is able to propose a number of solutions increasing the intensity of heat and mass exchange, limiting the impact of the construction and operation of heat and mass exchangers on the environment	[SW1] Assessment of factual knowledge
[K7_U05] is able to integrate technical and economic analysis of the use of various energy technologies, including technologies using renewable energy sources and conventional and nuclear energy	Student is able to choose the right one type of heat and mass exchanger for the respective application from a technical and economic point of view	[SU3] Assessment of ability to use knowledge gained from the subject
[K7_W06] knows the extended issues of reliability of power equipment and diagnostics of defects in this equipment	The student is familiar with TEMA regulations and knows the ranges of the relevant restrictions: corrosive environment, high temperature, maximum velocities, high pressure for heat exchangers.	[SW3] Assessment of knowledge contained in written work and projects

Subject contents

Part A. High-efficiency heat exchangers 1. Design of heat exchangers 2. Organization of the flow 3. Thermal efficiency of the heat exchanger 4. Intensification of heat transfer 5. Operation of heat exchangers

Part B. New working fluids 1. Ionic liquids 2. Nanofluids: a) Base liquids, nanoparticles, manufacturing methods; b) Thermophysical properties of nanofluids c) Convective heat transfer using nanofluids d) Application of nanofluids in thermal engineering 3. Selection of the working liquid

Part C. Introduction to mass transfer 1. Basic concepts 2. Diffusive mass transport 3. Convective mass transport 4. The law of conservation of substances for a stationary medium 5. The analogy between heat and mass transfer 5. Simultaneous transport of heat and mass

Prerequisites and co-requisites

Applied thermodynamics, heat and mass transport, energy conversion

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Design	56.0%	50.0%
Lecture	56.0%	50.0%

Recommended reading	Basic literature	**Cz. A** 1. Gupta J.P.: Fundamentals of Heat Exchanger and Pressure Vessel Technology, Hemisphere, Washington, DC, 1986. 2. Zohuri B.: Compact Heat Exchangers, Springer International Publishing Switzerland 2017, DOI 10.1007/978-3-319-29835-1_3 3. Pudlik W.: Wymiana i wymienniki ciepła. Wyd. 5 cyfrowe, Wyd. PG, 2012. 4. Pioro L.S., Pioro I.L.: Industrial Two-phase Thermosyphons. Begell House Inc. New York, Wallingford (UK) 1997. 5. Shah, R.K. and Focke, W.W., Plate Heat Exchangers and Their Design Theory, in Heat Transfer Equipment Design, ed. R.K. Shah, E.C. Subbarao, and R.M. Mashelkar, Hemisphere, Washington, DC, 1983 6. Webb RL. Principles of enhanced heat transfer, New York: Wiley, 1994 **Cz. B** 1. Das S.K. et al.: Nanofluids: Science and Technology, Wiley, 2007. 2. Ali M.H. (ed): Hybrid nanofluids for convection heat transfer, AP, 2020 **Cz. C** 1. Bergman T.L., Lavine A.S., Incropera F.P., Dewitt D.P.: Fundamentals of heat and mass transfer, J. Wiley&Sons, 2011 2. Kreith F., Manglik R.M., Bohn M.S., Tiwari S.: Principles of heat transfer, Cengage Learning, 2011
	Supplementary literature	Journals: • Nanomaterials • Powder Technology • Particuology • J. Therm. Anal. Calorim. • Int. J. Heat Mass Transfer • Nanoscale Research Letters • Heat Transfer Engineering • Experimental Thermal and Fluid Science • Applied Thermal Engineering
	eResources addresses	
Example issues/ example questions/ tasks being completed	A study/design on the use of heat exchangers in selected installations: • cryogenic installations, • nuclear reactor cooling systems, • microgravity conditions (space stations, installations on the moon), • heat exchangers in the pharmaceutical, food and other industries with increased hygiene standards, • installations of very high pressures and / or very high temperatures, • installations with highly corrosive agents, • special purpose installations, • mini- and micro heat exchangers	
Work placement	Not applicable	