GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Heat and mass transport, PG_00064816		
Field of study	Mechanical Engineering		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2024/2025
Education level	second-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	1	Language of instruction	Polish
Semester of study	1	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	exam
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	dr inż. Blanka Jakubowska prof. dr hab. inż. Janusz Cieśliński	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	0.0	0.0	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	15.0	40.0	100

Subject objectives	The objective of the course is to familiarize students with the theoretical foundations of heat and mass transfer processes, with a particular focus on the analysis of the physical phenomena involved in these processes. The course aims to highlight the analogy between these two types of transport, as well as to introduce advanced topics such as heat transfer during phase changes and modern solutions used in heat exchangers. The course content also covers the processes of simultaneous heat and mass transfer. The primary teaching method consists of theoretical analyses enriched with practical computational examples, enabling students to gain competencies in modeling and calculations related to heat and mass transfer.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W11] interprets social, economic, legal (including industrial and intellectual property laws), and other non-technical aspects of engineering activities, and includes them into engineering practice	The student explains how decisions regarding the design of heat and mass transport systems affect economic, legal and social aspects.	[SW3] Assessment of knowledge contained in written work and projects
[K7_W03] demonstrates a well-structured and theoretically grounded knowledge of the key issues in Mechanical Engineering to enable the design and diagnosis of mechanical systems, processes and devices	Based on the knowledge provided in the field of heat and mass transport mechanisms, the student demonstrates the ability to design and diagnose thermal flow devices.	[SW1] Assessment of factual knowledge
[K7_K12] is ready for fullfiling social commitement and initation of actions for public interest including entrepreneurial thinking and acting	The student demonstrates knowledge that allows him to identify engineering challenges related to heat and mass transport in the context of sustainable development and pro-ecological solutions, including renewable energy sources.	[SK5] Assessment of ability to solve problems that arise in practice [SK1] Assessment of group work skills
[K7_U11] communicates and justifies opinions on specialized topics in a manner understandable to diverse audiences, including the use of modern techniques, including information technology	The student explains and communicates the results of calculations and conclusions regarding heat and mass transport processes, using modern IT tools to present the results.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU5] Assessment of ability to present the results of task

Subject contents

LECTURE + EXERCISES

A. Heat transfer
1. Conduction, convection, radiation
2. Common heat transfer
3. Heat transfer with phase change
4. Heat exchangers

B. Mass transfer
1. Diffusion, convection,
2. Analogy between heat and mass transfer
3. Simultaneous heat and mass tarnsfe

Prerequisites and co-requisites

KNOWLEDGE:

- **Fundamentals of Thermodynamics** the student should understand the principles of thermodynamics, the concept of internal energy, enthalpy, entropy, and basic thermodynamic cycles.
- **Fluid Mechanics** knowledge of the basic principles of fluid mechanics, such as the continuity equation, Bernoulli's equation, Darcy's law, and flow resistance.
- **Fundamentals of Heat Transfer** the student should understand the basic mechanisms of heat transfer and be familiar with the fundamental formulas and methods for calculating them.
- **Differential Equations and Mathematical Analysis** the ability to solve differential equations (including partial differential equations) and knowledge of mathematical analysis (e.g., integration, differentiation, Laplace transforms).

SKILLS:

- **Advanced Engineering Calculations** the ability to perform more complex engineering calculations, such as heat flow calculations in complex heat exchange systems.

COMPETENCIES:

- **Teamwork Skills** the ability to work collaboratively in a team to solve complex engineering problems.
- **Communication of Results** the student should be able to communicate the results of calculations and analyses through reports, presentations, and discussions, both in written and oral forms.

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Numerical exercises	50.0%	50.0%
	Lecture	50.0%	50.0%
Recommended reading	Basic 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. Kreith F., Manglik R.M., Bohn M.S., Tiwari S.: Principles of heat transfer, Cengage Learning, 2011. 3. Pudlik W.: Wymiana i wymienniki ciepła. Wyd. PG, 1983	
	Supplementary literature	1.Serth R.W., Lestina T.G.: Process heat transfer, Elsevier, 2014. 2. Bird R.B., Stewart W.E., Lightfoot E.N.: Transport phenomena, John Wiley&Sons, 1960. 3. Hobler T.: Ruch ciepła i wymienniki. WNT W-wa, 1986.	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	1. Diffusion mechanism of heat and mass transport. 2. Equation of conservation of energy and mass. 3. Thermal and concentration boundary layer. 4. Lewis's law 5. Peclet's law. Logarithmic mean temperature difference		
Work placement	Not applicable		

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