GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Modeling of two-phase flows, PG_00057267		
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	Institute of Energy -> Faculty of Mechanical Engineering and Ship Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Rafał Andrzejczyk	
	Teachers	prof. dr hab. inż. Dariusz Mikielewicz dr hab. inż. Rafał Andrzejczyk mgr inż. Michał Pysz	

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

Subject objectives	Presentation of basic information on two-phase flows in installations energy.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_U02] is able to use known mathematical and numerical methods to analyze and design elements, systems and power transmission networks and internal installations	The student is able to carry out calculations for simple energy systems in which energy conversion takes place with the use of analytical and numerical models.	[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment
	[K7_W01] has extended and deepened knowledge of mathematics indispensable for describing phenomena related to processes of energy conversion and transfer; uses advanced information technologies	The student is able to perform calculations for simplephysical module of heat exchangers working of two-phase flow conditions. He can also analyze energy systems that use twophase flow for mass and energy transfer. The student is able to use simple computer software and create his own calculations based on the use of available databases of the properties of working fluents used in energy installations.	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
	[K7_W04] has advanced, ordered and theoretically grounded knowledge in the field of operation and selection of electrical machines, power transmission systems and power electronic devices, classical and forward-looking power technologies and their receivers, knows the principles of selection of power equipment and installations and their receivers and their operation	The student has knowledge of the impact of heat flux density on the operation of both individual elements and the entire power system. He can analyze and select the necessary methods of thermal stabilization of elements of machines and energy devices as well as transmission networks. The student is able to assess the influence of external conditions, operating parameters and time on the operation of the power installation.	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
	[K7_W05] knows basic methods, techniques and tools used in solving complex engineering tasks in the field of modeling of thermal-energy systems	The student has knowledge of twophase flow modeling at the level of a single section and the entire structure of the heat exchanger. He can also carry out calculations in the field of two-phase pressure drop .The student freely use basic tools to facilitate modeling of heat and energy systems, including in particular thermodynamic graphs for basic energyfluids, steam tables, databases of energy fluids properties available in open access applications.	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
Subject contents	Lecture 1. Introduction, basic definitions, flow structures, flow boiling, and condensation maps (2) 2. Pressure drop in two-phase flows. Analytical modeling of two-phase pressure drop by using of two-phase pressure drop multiplier (6) 3. The void fraction in two-phase flows (4) 4. Mathematical modeling of two-phase flows - homogeneous model, separated model, two-fluid model (6h) 5. Flow boiling channels and small diameter channels (2) 6. Flow condensation (4) 7. Designing of heat exchangers with the change of phase (6).8. The influence of heat flux density on the efficiency of energy systems. 9. Modeling of two-phase flows in energetic systems. Classes 1. Use of flow maps in modeling two-phase flow (2) 2. Calculating pressure drop in two-phase flow using two-phase multiplier models(4) 3. Calculation of void fraction and quality during a phase change (2)4. Thermal flow calculations during boiling in conventional and small diameter channels (4) 5. Thermal flow calculations during condensation (3) 6. Analytical calculations for simple condensers and evaporators (2).		
Prerequisites and co-requisites	mathematics I,II, heat transfer, thermodynamics, fluid mechanics		

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	written exam lecture	56.0%	50.0%
	written exam classes	56.0%	50.0%
Recommended reading	Basic literature	1. D. Mikielewicz, Wrzenie i kondensacja w przepływie w kanałach imikrokanałach, Wydawnictwo PG, Gdańsk 2009.2. Carey V. P., Liquid vapor phase change phenomena, Taylor andFrancis, 2008.3. Naterer G., Heat Transfer in Single and Multiphase Systems, CRCPress, 2003.4. Kandlikar S.G., Heat transfer and fluid flow in minichannels andmicrochannels, Elsevier, 2004. 5. S. M. Ghiaasiaan, Two-Phase Flow,Boiling and Condensation, Cambridge University Press, 2008.	
	Supplementary literature	No requirements	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	1.Determination of flow resistance in two phase flows in channels 2.Determination of heat transfer coefficient in flow boiling and flow condensation in channels3.Physical dmening of boiling number.4. Draw and describe boiling curve.		
Work placement	Not applicable		