

。 GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Modeling of non-equilibrium processes, PG_00065885								
Field of study	Nuclear 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			2.0			
Learning profile	general academic profile		Assessme	ssessment 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. Tomasz Muszyński						
	Teachers dr hab. inż. Tomasz Muszyński								
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Projec	Project Se		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		5.0		15.0		50	
Subject objectives	The aim of the course is to present the main mechanisms and laws of thermodynamics related to nonequilibrium processes. Students will become familiar with various approaches to the analysis of these processes and will analyze examples of nonequilibrium processes and their description. Additionally, the course introduces topics related to the analysis of processes using the criterion of minimum entropy production.								

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Importance and test selected hypotheses present the results of task issues in nuclear energy, with the afficiency, rationality, operation, safety and impact on the environment, as well as simple research problems present the results of task fulfilment [K7_UOI] Unitizes acquired analytical, simulation, and experimental methods, as well as mathematical models to analyse and evalue processes occurring in nuclear power sector and related industries The student understands the issues related to heat exchange cycles. This knowledge allows for the reaction of mathematical models of thermodynamic cycles. This knowledge allows for and evaluate processes cocurring in nuclear power sector and related industries [SU3] Assessment of ability to use knowledge allows for cycles. This knowledge allows for cycles. This knowledge allows for and evaluate processes cocurring in nuclear power sector and related industries [SU4] Assessment of ability to use methods and tools Subject contents 1. Principles of Thermodynamics. Reversible and inversible Processes. 2. Local Formulation of the Second Law of Thermodynamics. 3. Thermodynamics fruit processes. Minimization of Entropy Sources. 6. Exergy, Exergonic Efficiency. Exergy Balance. Prerequisites and co-requisites Thermodynamics, fluid mechanics, mathematics, physics, heat transfer Assessment methods and criteria Thermodynamics, fluid mechanics, mathematics, physics, heat transfer Recommended reading Basic literature 6. Lebon, D. Jou, J. Casas-Vazquez: Understanding Non-equilibrium Thermodynamics, Springer-Verlag Berlin, 2008 Bejan A., Advanced engineering thermodyna		structured and theory supported knowledge encompassing key issues in the field of Nuclear Power Technologies enabling modeling and analysis of processes, systems, machines and devices of a nuclear power	grounded, detailed knowledge of nonequilibrium thermodynamics, with a particular focus on the processes occurring within nuclear	contained in written work and				
analytical, simulation, and emprovemental methods, as well as the methods and related to heat exchange processes and thermodynamic subject subject and evaluate processes occurring in nuclear power sector and related in dustries issues related to heat exchange processes and thermodynamic subject (SU4) Assessment of ability to use methods and tools Subject contents 1. Principles of Thermodynamics. Reversible and inversible processes. 2. Local Formulation of the Second Law of Thermodynamics. 3. Thermodynamic Driving Forces and Flows, Entropy Source, Entropy Balance. Subject contents 1. Principles of Thermodynamics. Reversible and interversible Processes. 3. Coupled Processes. Curies Principle. Linear Processes. Minimization of Entropy Balance. Subject contents 3. Thermodynamics, fluid mechanics, mathematics, physics, heat transfer Processes. 6. Exergy, Exergonic Efficiency. Exergy Balance. Prerequisites and correquisites Thermodynamics, fluid mechanics, mathematics, physics, heat transfer Assessment methods and related is the second and of the second as of thermodynamics. 50.0% Recommended reading Subject passing criteria Passing threshold Percentage of the final grade solve. Recommended reading Basic literature G. Lebon, D. Jou, J. Casas-Vázquez: Understanding Non-equilibrium Thermodynamics, Springer-Verlag Berlin, 2008 Bejan A., Advanced engineering thermodynamics of Power and Refigeration Cycles, Springer , 201 Recommended reading Example issues/ Ma		hypotheses concerning problems related to processes occurring in Nuclear Power Technologies, their efficiency, rationality, operation, safety and impact on the environment, as well as simple	and test selected hypotheses related to heat transfer and flow issues in nuclear energy, with the aim of identifying the energy	present the results of task [SU1] Assessment of task				
2. Local Formulation of the Second Law of Thermodynamics. 3. Thermodynamic Driving Forces and Flows, Entropy Source, Entropy Balance. 4. Coupled Processes. Curie's Principle. Linear Processes. Onsager's Principle. 5. Sources of Entropy in Heat and Mass Transfer Processes. Onsager's Principle. 7. Thermodynamic Driving Forces and Flows, Entropy Source, Entropy Balance. 6. Exergy, Exergonic Efficiency. Exergy Balance. Prerequisites Thermodynamics, fluid mechanics, mathematics, physics, heat transfer Assessment methods Subject passing criteria Passing threshold Percentage of the final grade Tutorial test 50.0% 50.0% 50.0% Recommended reading Basic literature G. Lebon, D. Jou, J. Casas-Vázquez: Understanding Non-equilibrium Thermodynamics, Springer-Verlag Berlin, 2008 Supplementary literature Kaushik S.C. et al. Finite Time Thermodynamics of Power and Refrigeration Cycles, Springer , 201 eResources addresses Adresy na platformie eNauczanie: Example issues/ example questions/ tasks being completed How can the second law of thermodynamics be applied to analyze heat flow? What are the main sources of entropy in heat and mass transfer processes? What does exergonic efficiency mean, and how can it be applied to evaluate system performance?		analytical, simulation, and experimental methods, as well as mathematical models to analyse and evaluate processes occurring in nuclear power sector and	issues related to heat exchange processes and thermodynamic cycles. This knowledge allows for the creation of mathematical models of thermodynamic processes, enabling the prediction and analysis of their behavior	use knowledge gained from the subject [SU4] Assessment of ability to				
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Work placement Not applicable	Work placement	Not applicable						

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