



Subject card

Subject name and code	Passive methods in heat transport, PG_00053658						
Field of study	Mechanical Engineering, Mechanical Engineering						
Date of commencement of studies	October 2020	Academic year of realisation of subject	2022/2023				
Education level	first-cycle studies	Subject group					
Mode of study	Full-time studies	Mode of delivery	at the university				
Year of study	3	Language of instruction	English				
Semester of study	5	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. Paweł Szymański					
	Teachers	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	0.0	15.0	0.0	30
	E-learning hours included: 0.0						
	Address on the e-learning platform: https://enauczanie.pg.edu.pl/moodle/course/view.php?id=6441						
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	0.0	0.0	30		
Subject objectives	The main objectives of the course: <ul style="list-style-type: none">To teach students the issues of passive methods of heat transfer;To explain passive methods of heat transfer, such as heat conduction in fins and heat sinks, as well as passive heat dissipation methods in electronic devices. Additionally, will be explained the state-of-the-art methods of heat dissipation, such as heat pipes, thermosiphons, loop heat pipes, steam chambers, thermoelectric coolers, phase change materials and the operation of graphene to intensification a heat transfer.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	K6_U06	Upon completion of the course, the student will be able to select, estimate and calculate a passive heat exchanger such as a fin, heat sink, heat pipe, loop heat pipe etc.	[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
	K6_U01	The student is able to acquire information from literature, databases, and other resources necessary to solve engineering tasks; can integrate information obtained and make their interpretation, and draw conclusions and present reasoned opinions	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU5] Assessment of ability to present the results of task
	K6_W09	The student will acquire basic knowledge of heat transfer, in particular of passive methods of heat transfer.	[SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
	K6_W12	The student has a basic knowledge necessary to understand the phenomena associated with heat transfer, in particular with its passive methods. He knows the general principles of selection and calculation of passive heat exchangers.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
Subject contents	<ul style="list-style-type: none"> • Introduction importance of passive methods of heat transfer; • Principles of HeatTransfer; • HeatTransfer Mechanisms; • Fins and Heat Sinks; • Thermal Resistance Network; • Thermal Specification of Microelectronic Packages; • Fundamentals of Convection Heat Transfer; • Natural Convection HeatTransfer; • Radiation HeatTransfer; • Advanced CoolingTechnologies (Heat Pipes, Thermosyphons, Loop Heat Pipes, Vapor Chambers, Thermoelectric Coolers, Phase-change materials, graphene); 		
Prerequisites and co-requisites	Basic knowledge of mathematics, thermodynamics, physics and strength of materials		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Project - correct completion of the project	56.0%	50.0%
	Lecture - exam	56.0%	50.0%
Recommended reading	Basic literature	• "Heat Transfer: Thermal Management of Electronics" by Younes Shabany	
	Supplementary literature	• "Heat Pipes, Theory, Design and Applications" by David.Reay, Peter Kew	
	eResources addresses	Adresy na platformie eNauczanie: Passive Methods in Heat Transport, W/P, DPE, sem.5, zimowy 22/23 - Moodle ID: 26542 https://enauzanie.pg.edu.pl/moodle/course/view.php?id=26542	
Example issues/ example questions/ tasks being completed	The multiple case studies, examples and solved design problems from the field of heat transfer and the passive heat exchangers		
Work placement	Not applicable		