



## 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: <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=6441">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=6441</a>						
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	<b>The main objectives of the course:</b> <ul style="list-style-type: none"><li>• To teach students the issues of passive methods of heat transfer;</li><li>• 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.</li></ul>						

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"><li>• Introduction importance of passive methods of heat transfer;</li><li>• Principles of HeatTransfer;</li><li>• HeatTransfer Mechanisms;</li><li>• Fins and Heat Sinks;</li><li>• Thermal Resistance Network;</li><li>• Thermal Specification of Microelectronic Packages;</li><li>• Fundamentals of Convection Heat Transfer;</li><li>• Natural Convection HeatTransfer;</li><li>• Radiation HeatTransfer;</li><li>• Advanced CoolingTechnologies (Heat Pipes, Thermosyphons, Loop Heat Pipes, Vapor Chambers, Thermoelectric Coolers, Phase-change materials, graphene);</li></ul>		
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 <a href="https://enauzanie.pg.edu.pl/moodle/course/view.php?id=26542">https://enauzanie.pg.edu.pl/moodle/course/view.php?id=26542</a>	
Example issues/ example questions/ tasks being completed	The multiple case studies, exaples and solved design problems from the field of heat transfer and the passive heat exchangers		
Work placement	Not applicable		