

§ GDAŃSK UNIVERSITY § OF TECHNOLOGY

Subject card

Subject name and code	Parallel Programming for Multi-Core Architecture, PG_00054396							
Field of study	Informatics							
Date of commencement of studies	February 2023		Academic year of realisation of subject		2023/2024			
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		4.0			
Learning profile	general academic profile		Assessment form		exam			
Conducting unit	Department of Computer Architecture -> Faculty of Electronics, Telecommunications and Informatics							
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Paweł Czarnul					
	Teachers		dr hab. inż. Paweł Czarnul mgr inż. Robert Kałaska					
Lesson types and methods	Lesson type	Lecture	Tutorial	Laboratory	Proiec	t	Seminar	SUM
of instruction	Number of study hours	30.0	0.0	15.0	15.0	-	0.0	60
	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	60		2.0		38.0		100
Subject objectives	learning techniques of parallel programming and APIs allowing use of modern manycore platforms							

Learning outcomes	Course outcome	Subject outcome	Method of verification	
	[K7_U04] can apply knowledge of programming methods and techniques as well as select and apply appropriate programming methods and tools in computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study, making assessment and critical analysis of the prepared software as well as a synthesis and creative interpretation of information presented with it	student knows how to select appropriate APIs and optimization methods for applications running on multicore systems	[SU1] Assessment of task fulfilment	
	[K7_W04] Knows and understands, to an advanced extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study, and organisation of systems using computers or such devices	student knows basic rules and techniques of multithreaded programming for multi-core architectures	[SW1] Assessment of factual knowledge	
	[K7_W06] Knows and understands, to an increased extent, the basic processes taking place in the life cycle of devices, facilities and technical systems.	student knows profiling and debugging techniques of parallel applications	[SW1] Assessment of factual knowledge	
	[K7_U42] can solve engineering and research problems including design, assessment and maintenance of information systems and applications, using experimental methods and management techniques	student knows how to design and evaluate execution of a multithreaded application	[SU1] Assessment of task fulfilment	
	[K7_W42] Knows and understands, to an increased extent, the principles and trends in the analysis and design of local and distributed IT systems and the basics of computer modeling and computerization of complex cognitive and decision-making processes.	student knows how to analyze multithreaded applications	[SW1] Assessment of factual knowledge	
Subject contents	 Passing criteria Current HPC systems Goals of parallel programming GPU as a parallel compute devition Data decomposition Data parallel algorithms CUDA programming model GPU architecture Threads in CUDA Memory access in CUDA Optimizations using CUDA Optimization debugging Unified Memory OpenCL for GPUs/CPUs Many/multicore architectures OpenMP Offload, native, symmetric model Parallelization models for variou Vectorization False sharing Thread affinity Synchronization Optimization computing similarit RCPU+GPU programming 	ce es inchronization) is paradigms in OpenMP.		

Prerequisites and co-requisites	basic knowledge of parallel programming C programming knowledge					
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade			
	exam	50.0%	30.0%			
	project	50.0%	25.0%			
	laboratories	50.0%	25.0%			
	colloquium 1 + 2	50.0%	20.0%			
Recommended reading	Basic literature	 [1] Pawel Czarnul. Parallel Programming for Modern High Performance Computing Systems. Taylor & Francis. 2018 ISBN 9781138305953 [2] CUDA C programming guide. NVIDIA [3] OpenMP specification [4] OpenCL specification 				
	Supplementary literature	CUDA documentation - NVIDIA presentations				
	eResources addresses	Adresy na platformie eNauczanie: Programowanie równoległe na architekturach wielordzeniowych NOWY - Moodle ID: 32589 https://enauczanie.ng.edu.pl/moodle/course/view.php?id=32589				
Evennle ieevee/			e/course/view.prip?u=32309			
Example Issues/ example questions/ tasks being completed						
Work placement	Not applicable					