University of Gdańsk

Subject card

Subject name and code	Quantum Computation, PG_00158051						
Field of study	Quantum Information Technology						
Date of commencement of studies	October 2024		Academic year of realisation of subject		2024/2025		
Education level	postgraduate studies		Subject group		Obligatory subject group in the field of study		
Mode of study	full-time studies		Mode of delivery		at the university		
Year of study	1		Language of instruction		English		
Semester of study	2		ECTS credits		6.0		
Learning profile	academic		Assessment form				
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Paweł Mazurek				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	0.0	0.0	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		0.0		30.0	90
Subject objectives	To provide the student with information about current state of art in quantum computing, basic algorithms and subroutines, nature of quantum advantage, and operational challanges.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[QITL3_W01] has extended knowledge in the field of general physics and advanced knowledge in the area of quantum information theory; knows the history of the development of quantum information theory and its importance for the progress of science, knowledge of the world and social development	The students knows basic algorithms and subroutines used in quantum computation and simulation.	[SW4] test/exam - oral or written
[QITL3_W04] knows advanced methods of theoretical and mathematical physics necessary in creating models of quantum mechanics	Student knows and can apply structures of fault tolerant quantum error correction.	[SW4] test/exam - oral or written
[QITL3_W02] has in-depth knowledge in the field of advanced mathematics and mathematical and computer methods, necessary to solve physical problems of medium complexity, and advanced knowledge in the area of quantum information and its technological aspects	Student can model and solve computational problems using QuTiP library.	[SW4] test/exam - oral or written
[QITL3_U02] has the skills to plan and conduct basic and advanced research and calculations in the area of quantum information theory or its applications	Student can determine complexity of classical and quantum algorithms and allocate associated problems to complexity classes.	[SU4] test/exam - oral or written
[QITL3_U01] is able to apply the scientific method in solving physical problems and reasoning in the field of quantum information theory	Student is aware about experimental and theoretical challanges of quantum computation, can relate current quantum computing implementations within this context, makes predictions about future development of the field. Can perform simulations of quantum computing and draw conclusions about feasibility of the technology.	[SU1] oral statement/conversation/ discussion [SU4] test/exam - oral or written

Subject contents

Current state of art in quantum computing and challanges. No cloning and basics of quantum error correction. Sets of universal gates for quantum computation. The Deutsch-Josza and Bernstein-Vazirani algorithms. Simon's algorithm and applications to cryptography. The Quantum Fourier Transform. Shor's quantum factoring algorithm. Grover search and approximate counting. Variational Quantum Eigensolver algorithm

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
tutorial part: test	51.0%	50.0%
lecture part: exam	51.0%	50.0%

Recommended reading

Basic literature	Nielsen and Chuang, Quantum Computation and Quantum Information
Supplementary literature	None.
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed

Work placement

Not applicable

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