Zał. nr 5 do ZW 16/2020

Faculty of Information and Communication Technology/Department of Fundamentals of Computer Science

COURSE CARD

Name of the course in polish	:	**Fizyka i Obliczenia Kwantowe**
Name of the course in english	:	**Quantum Physics and Computing**
Field of study	:	Algoritmic Computer Science
Specialty (if applicable)	:	
Level and form of studies	:	II degree, stationary
Type of course	:	compulsory
Course code	:	W04INA-SM4013G
Group of courses	:	Yes

	Lectures	Exercides	Laboratory	Project	Seminar
Number of classes held in schools (ZZU)	15				
The total number of hours of student workload (CNPS)	30				
Assesment	pass				
For a group of courses final course mark	X				
Number of ECTS credits	1				
including the number of points corresponding to the classes of practical (P)					
including the number of points corresponding occupations requiring direct contact (BK)	1				

PREREQUISITES FOR KNOWLEDGE, SKILLS AND OTHER POWERS

knowledge of basic tools of mathematical analysis

COURSE OBJECTIVES

C1 knowledge of the principles of quantum computing

COURSE LEARNING OUTCOMES

The scope of the student's knowledge:

W1 basic knowledge of quantum physics sufficient to understand quantum algorithms

W2 has knowledge about the limitations and opportunities of quantum computing

W3 knows fundamental quantum algorithms and protocols

The student skills:

U1 can understand a quantum algorithm

U2 can estimate the computational complexity of a quantum algorithm

U3 can evaluate the usefulness of a quantum system

The student's social competence:

K1 Ability to evaluate the economics and applicability of quantum computing

K2 is aware of risks related to unconventional computational methods

COURSE CONTENT		
Type of classes - lectures		
Wy1	physical foundations for quantum systems for quantum computing and communication	5h
Wy2	qubits and quantum gates	2h
Wy3	protocols of quantum communication	2h
Wy4	breaking Discrete Logarithm Problem	2h
Wy5	quantum algorithm for factorization	2h
Wy6	Grover's algorithm	2h
	Sum of hours	15h

Applied learning tools
1. Traditional lecture 2. Multimedia lecture

EVALUATION OF THE EFFECTS OF EDUCATION ACHIEVEMENTS		
Value	Number of training effect	Way to evaluate the effect of education
F1	W1-W3, U1-U3, K1-K2	tests
P=100%*F1		

BASIC AND ADDITIONAL READING
1. CERN Academic Training Lectures: Heather Gray, Introduction to Quantum Computing, available online 2. Quantum Computing: Lecture Notes, Ronald de Wolf (QuSoft, CWI and University of Amsterdam), arXiv:1907.09415

SUPERVISOR OF COURSE
prof. Mirosław Kutyłowski

MATRIX OF LEARNING OUTCOMES FOR THE SUBJECT
Fizyka i Obliczenia Kwantowe
WITH LEARNING OUTCOMES IN THE FIELD OF ALGORITHMIC COMPUTER SCIENCE

Subject learning effect	Relating the subject effect to the learning outcomes defined for the field of study	Objectives of the course**	Program content**	Teaching tool number**
W1	K2_W01 K2_W02 K2_W03 K2_W04 K2_W05 K2_W07	C1	Wy1-Wy6	1 2
W2	K2_W01 K2_W02 K2_W03 K2_W04 K2_W05	C1	Wy1-Wy6	1 2
W3	K2_W01 K2_W02 K2_W03 K2_W04 K2_W07	C1	Wy1-Wy6	1 2
U1	K2_U05 K2_U08 K2_U12 K2_U13	C1	Wy1-Wy6	
U2	K2_U03 K2_U04 K2_U05 K2_U06 K2_U08	C1	Wy1-Wy6	
U3	K2_U08 K2_U10 K2_U11 K2_U12 K2_U13	C1	Wy1-Wy6	
K1	K2_K01 K2_K02 K2_K03 K2_K04 K2_K05 K2_K06 K2_K08 K2_K10 K2_K11	C1	Wy1-Wy6	1 2
K2	K2_K02 K2_K03 K2_K04 K2_K08 K2_K09 K2_K10 K2_K11	C1	Wy1-Wy6	1 2