EUROPEAN INFORMATION TECHNOLOGIES CERTIFICATION INSTITUTE, ASBL.

Brussels, Belgium, European Union

CERTIFICATE

Artur Marek Maciag

Has successfully completed test requirements of
The European Information Technologies Certification Programme

EITC/QI/QIF Quantum information and quantum computation fundamentals

Certification Programme examination result: 78%

Certification Programme description:

Introduction to quantum mechanics: quantum information formalism (Hilbert space, norms and measures, wave functions, orthogonal and non-orthogonal vectors, ON basis, unitary and hermitian operators, spectral decomposition of operators, Dirac notation, introduction to functional analysis), Quantum mechanics postulates: quantum state, unitary evolution and SchrÃ¶dinger-Heisenberg equation, quantum measurement (von Neumann projection, Zurek's induced superselection), Tensor product and quantum entanglement; quantum paradigm of information: definition (information as quantum state, sources of information), Unit of information (qubit), Representation on Bloch sphere, Bell states, Measure of entanglement and quantum information (von Neumann entropy), Schmidt representation, Quantum measurement of qubits, EPR and basics of locality and realism: breaking the Bell inequality, Non-local correlations of measurement results, Quantum teleportation, Superdense coding, Quantum circuits theory: Quantum logical gates (one-qubit Pauli gates, Hadamard gates, phases, multi-qubit CNOT gates, Toffoli gates, Fredkin gates), Universal set (CNOT and one-qubit gates), Reversability of quantum information processing by unitarity of systems' evolution, Quantum algorithms implementation (implementation of quantum Fourier transform - exponential acceleration, implementation of quantum teleportation); Quantum security aspects: Shor's algorithm for factorization, no-cloning theorem, non-deleting and non-broadcasting theorem, Quantum Key Distribution; Practical realizations of quantum computer: decoherence, DiVincenzo criteria, trapped ions technology, NMR, Quantum dots (orbital and spin degrees of freedom), Quantum information over topological degrees of freedom

Certificate Programme version/revision: EITC/QI/QIFv1r2

CERTIFICATE ID: **EITC/QI/QIF/ERF/15004715**

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DATE OF ISSUE:
December 2015
Brussels, Belgium
European Union