EUROPEAN INFORMATION TECHNOLOGIES CERTIFICATION INSTITUTE, ASBL.

Brussels, Belgium, European Union

# CERTIFICATE

## Francesco Mortandello

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

### EITC/QI/QIF Quantum Information Fundamentals

**Certification Programme examination result:** 73.33%

**Certification Programme description:**

Introduction to Quantum Mechanics: introduction to double slit experiment, double slit experiment with waves and bullets, conclusions from the double slit experiment; Introduction to Quantum Information: qubits, geometric representation, photon polarization, uncertainty principle; Quantum Entanglement: k-level system and bra-ket notation, systems of two qubits, entanglement, EPR paradox, Bell and EPR, rotational invariance of Bell state, CHSH inequality, Bell and local realism; Quantum Information processing: time evolution of a quantum system, unitary transforms, single qubit gates, two qubit gates; Quantum Information properties: no-cloning theorem, Bell state circuit, quantum teleportation, quantum teleportation using CNOT, quantum measurement; Introduction to Quantum Computation: n-qubit systems, universal family of gates, reversible computation, conclusions from reversible computation; Quantum Algorithms: Fourier sampling, applying Fourier sampling, Simon`s algorithm, conclusions from Simon`s Algorithm; Simon`s algorithm in terms of the double slit experiment, extended Church-Turing thesis; Quantum Fourier Transform: QFT overview, n-th roots of unity, discrete Fourier Transform, n-th dimensional Quantum Fourier Transform, properties of Quantum Fourier Transform; Shor`s Quantum Factoring Algorithm: period finding, Shor`s factoring algorithm, QFT circuit; Grover`s Quantum Search Algorithm: needle in a haystack, Grover`s algorithm, implementing Grover`s Algorithm; Observables and Schrodinger`s equation: introduction to observables, observables properties, Schrodinger`s equation; Introduction to implementing qubits: continous quantum states, Schrodinger`s equation for a 1D free particle, particle in a box, implementing qubits; Introduction to Quantum Complexity Theory: limits of quantum computers, adiabatic quantum computation, BQP; Introduction to spin: spin as a qubit, Bloch sphere, Stern-Gerlach experiment, Pauli spin matrices; Manipulating spin: Larmor precession, spin resonance, classical control

**Certificate Programme version/revision: EITC/QI/QIFv2r1**

CERTIFICATE ID: **EITC/QI/QIF/FXR25004782**

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