People's Democratic Republic of Algeria

Ministry of Higher Education and Scientific Research

Sétif 1 University – Ferhat Abbas

Faculty: Sciences

Master's Degree in QUANTUM COMPUTING

Presentation and objective of the specialty

Today, as computer networks infiltrate all aspects of our lives, training managers in cybersecurity has become essential.

Cybersecurity ensures that data is managed under secure conditions. It protects computer systems and circulating data from cybercriminals.

Nowadays, IT security affects all businesses and has become a crucial factor to consider.

Admission requirements:

- All Licence degree in Computer Science

Career Prospects/Professions:

- Research and Development scientist (R&D scientist)
- Quantum software engineer
- Quantum hardware engineer
- Quantum security specialist (cryptography, cyber-security)
- Artificial Intelligence
- Fraud detection in finance
- Development of new medicines, fertilizer production,
- Impact on energy and environment
- Healthcare: accelerate understanding of diseases and improve the precision of the treatments,
- Meteorology
- Logistics……

Admission Information:

The current application of Articles 171 and 1023 of Decrees:

- Skills and knowledge acquisition are assessed every six months through continuous assessment and a final exam.
- Progress from the first to the second year is automatic if the student has completed the first two semesters of the training program.

Organization of Studies and Official Duration of the Program:

Program Overview:

Semestre 1 :

Algorithms and Parallel Architectures
Advanced Algorithms and complexity
Quantum Mechanics
Advanced Linear Algebra
Artificial Intelligence
Advanced Networking
Nano Electronics
Communication in English

Semestre 2 :

Quantum Computing and Algorithms
Programming language for quantum computing
Building Quantum Computer
Cryptology
Advanced probabilities
Unix System Administration
Spintronic
Communication in English 2

Semestre 3:
Quantum Cryptography
Quantum Errors Correction
Machine Learning
Simulation and Optimisation
Applied Quantum Computing
Formal Methods for Quantum Computing
Entrepreneurship
Research Methodology

Semestre 4:
Final Year Project

Curriculum Highlights:

It's important to note that the field of quantum computing is rapidly evolving, and the objectives of a this Master's program may evolve over time to align with advancements in technology and new discoveries in the field. Here are some common objectives for a Master's program in quantum computing: - Develop a deep understanding of quantum theory: The program aims to provide students

- The student's assessment focuses on, depending on the training program: lectures, practical work, tutorials, and practical internships.

Training Canvas:

Algorithms and Parallel Architectures
Advanced Algorithms and complexity
Quantum Mechanics
Artificial Intelligence
Nano Electronics
Quantum Computing and Algorithms
Programming language for quantum computing
Building Quantum Computer

Advanced training modules:

Quantum Cryptography
Quantum Errors Correction
Machine Learning
Simulation and Optimisation
Applied Quantum Computing
Formal Methods for Quantum Computing
Entrepreneurship
Research Methodology

Language of instruction:

French and English

Training framework:

The tables provided in the previous section "Program Overview"

Coordinator of the Program:

Dr Safia Djemame Zazoua

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with a solid foundation in quantum mechanics and quantum information theory. This includes understanding principles such as s uperposition, entanglement, quantum gates, quantum algorithms, and quantum error correction.
- Gain proficiency in quantum programmin g: Students will learn how to write and a nalyze
quantum algorithms using programming la nguages and frameworks specific to quant um
computing, such as Qiskit, Cirq, or IBM Quantum Experience. They will develop s kills in
translating classical problems into quantum algorithms and optimizing them for quant um systems.
- Explore quantum hardware and technolo gies: The program may cover the underlyi ng
hardware architectures and technologies used in quantum computing, including superconducting qubits, trapped ions, topol ogical qubits, and other emerging quantum computing platforms. Students may gain h ands-
on experience with experimental setups and quantum simulators.
- Investigate quantum applications and use cases: Students will explore various applications of quantum computing across different domains, such as cryptography, optimization,
machine learning, chemistry simulations, a nd quantum simulation. They may delve i nto case studies and real-
world examples to understand the potential impact of quantum computing.
- Prepare for careers in quantum computing: The program aims to equip students with the necessary skills and knowledge to pursue careers in quantum computing. This includ es
roles in research and development, quantu m software engineering, quantum algorithm design, quantum information theory, and quantum consulting.