multisoft
Systems

# Quantum Algorithms & Applications Training

*COURSE CONTENT*


GET IN TOUCH

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## About Multisoft

Train yourself with the best and develop valuable in-demand skills with Multisoft Systems. A leading certification training provider, Multisoft collaborates with top technologies to bring world-class one-on-one and certification trainings. With the goal to empower professionals and business across the globe, we offer more than 1500 training courses, which are delivered by Multisoft's global subject matter experts. We offer tailored corporate training; project Based Training, comprehensive learning solution with lifetime e-learning access, after training support and globally recognized training certificates.

## About Course

The Quantum Algorithms & Applications Training by Multisoft Systems is designed to equip learners with a solid foundation in quantum computing concepts and their real-world applications. This comprehensive program delves into the principles of quantum mechanics that power quantum computers, including superposition, entanglement, and quantum interference.

## Module 1: Introduction to Quantum Computing

- ✓ Understanding Classical vs Quantum Computing
- ✓ Quantum Mechanics Principles for Computation
- ✓ Qubits, Superposition, and Entanglement
- ✓ Quantum Gates and Circuits
- ✓ Quantum Measurement and State Collapse
- ✓ The Role of Quantum Parallelism

## Module 2: Mathematical Foundations

- ✓ Linear Algebra Refresher (Vectors, Matrices, Eigenvalues)
- ✓ Complex Numbers and Hilbert Spaces
- ✓ Tensor Products and Kronecker Operations
- ✓ Probability Theory in Quantum Systems
- ✓ Quantum State Representation and Operators

## Module 3: Quantum Logic and Circuits

- ✓ Single and Multi-Qubit Gates
- ✓ Controlled Gates and Quantum Registers
- ✓ Quantum Circuit Design and Optimization
- ✓ Simulation of Quantum Circuits
- ✓ Quantum Programming Frameworks (Qiskit, Cirq)

## Module 4: Key Quantum Algorithms

- ✓ Deutsch-Jozsa Algorithm – Problem Solving through Superposition
- ✓ Grover's Algorithm – Quantum Search Optimization
- ✓ Shor's Algorithm – Quantum Factorization and Cryptography
- ✓ Quantum Fourier Transform (QFT) – Core of Many Quantum Algorithms
- ✓ Quantum Phase Estimation (QPE) – Precision and Eigenvalue Problems
- ✓ Variational Quantum Eigensolver (VQE) – Hybrid Quantum-Classical Computation

## Module 5: Quantum Machine Learning (QML)

- ✓ Introduction to QML and Hybrid Architectures
- ✓ Quantum Data Encoding Techniques
- ✓ Quantum Support Vector Machines (QSVM)
- ✓ Quantum Neural Networks (QNN)
- ✓ Applications in Pattern Recognition and Optimization

## Module 6: Quantum Error Correction & Noise Management

- ✓ Quantum Decoherence and Noise
- ✓ Quantum Error Correction Codes (QECC)
- ✓ Fault-Tolerant Quantum Computation
- ✓ NISQ Devices and Limitations

## Module 7: Real-World Applications of Quantum Algorithms

- ✓ Quantum Cryptography and Secure Communications
- ✓ Quantum Chemistry and Molecular Simulation
- ✓ Optimization Problems (Traveling Salesman, Scheduling)
- ✓ Financial Modeling and Risk Analysis
- ✓ Quantum AI and Data Science Applications

## Module 8: Hands-on Labs and Case Studies

- ✓ Implementing Grover's and Shor's Algorithms in Qiskit
- ✓ Quantum Circuit Design Exercises
- ✓ Building a Quantum Search Application
- ✓ Simulating Quantum Machine Learning Models
- ✓ Exploring Cloud Quantum Platforms (IBM Quantum Experience, Azure Quantum)

## Module 9: Emerging Trends and Future of Quantum Computing

- ✓ Advances in Quantum Hardware
- ✓ Quantum Supremacy and its Implications
- ✓ Quantum Internet and Secure Networking
- ✓ Hybrid Quantum-Classical Systems
- ✓ Industry Use Cases (IBM, Google, D-Wave, Microsoft)