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Course Name

Introduction to Quantum Computing

Sector Name

Information Technology

Document Type

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Introduction to Quantum Computing

Course Introduction

Quantum Computing

Quantum Computing focuses on developing computer technology based on quantum theory principles. Quantum computers use quantum mechanics fundamentals to speed up the process of solving complex computations, as it spurs the development of new breakthroughs in science, medicine, machine learning, financial strategies, and algorithms.

This training program is designed to provide knowledge on quantum mechanics and practical applications of quantum computing. This course covers topics about classical circuits and quantum circuits, the concept of Quantum parallelism, and Quantum algorithms.

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Introduction to Quantum Computing

Target Audience

Professionals, researchers, and students with a background in technology, physics, or mathematics who are interested in exploring the principles and applications of quantum computing and its potential impact on industries like cryptography, AI, and data analysis.

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Introduction to Quantum Computing

Learning Objectives

- ✓ Gain a comprehensive understanding of the concepts of quantum computing and quantum mechanics.
- ✓ Learn the Grover’s Search and Quantum Walk Algorithm.
- ✓ Familiarized oneself with the concept of Quantum Cryptography.

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Introduction to Quantum Computing

Course Outline

✓ Day 01

Introduction to Quantum Computing

- ✓ Quantum Mechanics
- ✓ Qubits and Quantum Memory
- ✓ Elementary Gates

Overview of Circuit Model and Deutsch-Jozsa

Introduction to Simon's Algorithm

The Fourier Transform

- ✓ Classical Discrete Fourier Transform
- ✓ Fast Fourier Transform
- ✓ Application – Multiplying Two Polynomials
- ✓ Quantum Fourier Transform
- ✓ Quantum Circuit
- ✓ Shor's Factoring Algorithm
- ✓ Hidden Subgroup Problem

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Introduction to Quantum Computing

Course Outline

✓ Day 02

Grover's Search and Quantum Walk Algorithm

- ✓ Grover's Algorithm
- ✓ Amplitude Amplification
- ✓ Application: Satisfiability
- ✓ Quantum Walk

Applications

- ✓ Grover Search
- ✓ Collision Problem
- ✓ Finding a Triangle in a Graph
- ✓ Overview of Hamiltonian Simulation

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Introduction to Quantum Computing

Course Outline

✓ Day 03

Introduction to HHL Algorithm

- ✓ Linear Systems Problem
- ✓ HHL Algorithm for Linear Systems
- ✓ Improving HHL Algorithm Complexity
- ✓ Quantum Query Lower Bounds
- ✓ Quantum Complexity Theory

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Course Outline

✓ Day 04

Quantum Encodings with a Non-Quantum Application

- ✓ Quantum Communication Complexity
- ✓ Entanglement and Non-Locality
- ✓ Quantum Non-Locality
- ✓ CHSH: Clauser-Horne-Shimony-Holt
- ✓ Magic Square Game

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Introduction to Quantum Computing

Course Outline

✓ Day 05

Introduction to Quantum Cryptography

- ✓ Error-Correction and Fault-Tolerance
- ✓ Introduction
- ✓ Classical Error-Correction
- ✓ Quantum Errors
- ✓ Quantum Error-Correcting Codes
- ✓ Fault-Tolerant Quantum Computation
- ✓ Concatenated Codes and Threshold Theorem

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Confirmed Sessions

FROM	TO	DURATION	FEES	LOCATION
June 28, 2027	July 2, 2027	5 days	4950.00 $	England , London
Aug. 16, 2027	Aug. 20, 2027	5 days	4250.00 $	UAE , Dubai
Oct. 18, 2027	Oct. 22, 2027	5 days	4250.00 $	UAE , Abu Dhabi
Feb. 1, 2027	Feb. 5, 2027	5 days	4250.00 $	UAE , Dubai

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