CS313: Quantum Computing	L	T	P	Algorithms
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Course Objective: To provide a comprehensive understanding of quantum computing, covering qubits, quantum circuits, quantum cryptography, algorithms, error correction, and practical implementations.

S. No	Course Outcomes (CO)
CO1	Demonstrate a clear understanding of qubits, their representation, and the Bloch sphere for visualizing quantum states.
CO2	Design and analyze quantum circuits using various quantum gates and architectures.
CO3	Apply principles of quantum cryptography and information theory to real-world cryptographic protocols such as quantum key distribution and quantum teleportation.
CO4	Implement and compare quantum algorithms like Deutsch's, Shor's, and Grover's for solving complex computational problems.
CO5	Analyze and apply quantum error correction techniques and evaluate different quantum computing implementations (e.g., NMR, ion traps, optical methods).

S. No	Contents	Contact Hours
UNIT 1	Introduction to Quantum Computing : Qubits and their representation, multiple qubits, entanglement, Bloch sphere representation of a qubit.	**10**
UNIT 2	Quantum Logic Elements and Circuits : Quantum logic gates (Hadamard, Pauli-X, CNOT, etc.), design of quantum circuits, architectures of quantum computers, quantum circuit operations.	**10**
UNIT 3	Quantum Information and Cryptography : Quantum Key Distribution (QKD), quantum teleportation, single photons, EPR pairs, Bell states, quantum cryptography, no cloning theorem.	**10**
UNIT 4	Quantum Algorithms : Introduction to quantum algorithms, Deutsch's algorithm, Deutsch-Jozsa algorithm, Shor's factorization algorithm, Grover's search algorithm.	**10**
UNIT 5	Error Correction and Implementations: Quantum error correction, fault-tolerant computation, graph states and quantum codes, implementations of quantum computers (NMR, Ion trap, optical implementations).	**8**
	Total	**48**