QUANTUM COMPUTING

Course Code	23CS4501D	Year	III	Semester	I
Course Category	Professional Core	Branch	CSE	Course Type	Theory
Credits	3	L – T – P	3 – 0 - 0	Prerequisites	
Continuous Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
		Level
CO1	Understand the fundamentals of quantum computing , quantum cryptography and teleportation protocols , foundational physics principles and their role in quantum information processing.	L2
CO2	Apply foundational mathematical and physical principle, and quantum probability to model quantum systems and measurements.	L3
CO3	Apply qubit models and quantum gate operations, and represent quantum states using Bloch sphere visualizations	L3
CO4	Apply quantum algorithms for a given problem and Evaluate key concepts in quantum cryptography & information theory	L3
CO5	Analyze the given scenario and use appropriate methods/mechanisms/protocols for solve classical problems using quantum paradigms	L4

Syllabus

Unit No.	CONTENTS	Mapped CO
UNIT - I	History of Quantum Computing: Importance of Mathematics, Physics and Biology. Introduction to Quantum Computing: Bits Vs Qubits, Classical Vs Quantum logical operations	CO1
UNIT - II	Background Mathematics: Basics of Linear Algebra, Hilbert space, Probabilities and measurements. Background Physics: Paul's exclusion Principle, Superposition, Entanglement and super-symmetry, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis.	CO1,CO2, CO5
UNIT - III	Qubit: Physical implementations of Qubit. Qubit as a quantum unit of information. The Bloch sphere Quantum Circuits: single qubit gates, multiple qubit gates, designing the quantum circuits. Bell states.	CO1,CO3, CO5

UNIT - IV	Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor's factorization algorithm, Grover's search algorithm.	**CO1,CO4, CO5**
UNIT - V	Quantum Information and Cryptography: Comparison between classical and quantum information theory. Quantum Cryptography, Quantum teleportation	**CO1,CO4, CO5**

Learning Resources
Text Books
Text Books: 1. Quantum Computation and Quantum Information, Nielsen M. A.,Cambridge 2. Programming Quantum Computers, Essential Algorithms and Code Samples, Eric R Johnson, Nic Harrigan, Mercedes Ginemo, Segovia, Oreilly.
Reference Books
1. Quantum Computing for Computer Scientists, Noson S. Yanofsk, Mirco A. Mannucci
E-Resources & other digital material
I. Introduction to Quantum Computing: Quantum Algorithms and Qiskit - Course 2. NPTEL :: Physics - NOC:Quantum Information and Computing 3. Quantum Computing – NPTEL+