K. J. Somaiya Institute of Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)

May-June 2024-25
Program: B. Tech Scheme: II
Regular Examination:LY Semester: VIII
Course Code:AIDLC8031 and Course Name: Quantum Computing
Date of Exam: 23/05/2025 Duration: 02.5 Hours Max. Marks: 60

Instructions:
(1)All questions are compulsory.
(2)Draw neat diagrams wherever applicable.
(3)Assume suitable data, if necessary.

Q. No.	Question	Max. Marks	CO	BT level
Q 1	Solve any two questions out of three: (05 marks each)	10		
a)	What is the fundamental difference between classical and quantum computing?		CO1	U
b)	Prove that hadamard basis vectors are orthonormal.		CO2	U
c)	What is the main difference between classical probabilistic computation and quantum computation?		CO3	U
Q 2	Solve any two questions out of three: (05 marks each)	10		
a)	What is the role of randomness in probabilistic algorithms and superposition in quantum algorithms?		CO4	U
b)	How does quantum amplitude amplification differ from classical probability amplification?		CO4	U
c)	Compare and contrast classical error models with quantum error models.		CO5	U
Q.3	Solve any two questions out of three. (10 marks each)	20		
a)	i)Derive the expressions for |0> and |1> in terms of Hadamard Basis |+> and |- > .	5	CO1	An
	ii)How does the Controlled-NOT (CNOT) gate operate on two qubits? Provide an example	5		An
b)	What is the spectral theorem? Explain in detail.	10	CO2	U

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c)	Explain the concept of unitary evolution in quantum computing. Derive the matrix representation of the NOT gate and discuss its significance in quantum circuits.	10	CO3	U
Q.4	Solve any two questions out of three. (10 marks each)	20		
a)	Explain the Deutsch Algorithm in detail. Describe the quantum circuit used and explain how it determines whether a function is constant or balanced with a single query.		CO4	U
b)	Evaluate the real-world applicability and limitations of Grover's algorithm in current quantum hardware		CO4	An
c)	Explain the working of the 3-qubit quantum error correcting code. How does it correct bit-flip or phase-flip errors?		CO5	U

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