Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

Mid - Term Examinations – MARCH 2026

Date: 10- 03- 2026 **Time:** 09:30am – 11:00am

School: SOCSE	**Program:** Computer Science & Information Technology	
Course Code: CSI2503	**Course Name:** Quantum Computing	
Semester: VI	**Max Marks**: 50	**Weightage**: 25%

CO - Levels	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Marks	**26**	**24**			

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **5Q x 2M=10M**

1	Define a qubit and represent it on the Bloch sphere.	**2 Marks**	**L1**	**CO1**
2	State any two postulates of quantum mechanics used in quantum computing.	**2 Marks**	**L1**	**CO1**
3	What is quantum measurement? Mention its probabilistic nature.	**2 Marks**	**L1**	**CO1**
4	Write the general mathematical expression of a single-qubit quantum state.	**2 Marks**	**L2**	**CO2**
5	Write the matrix of Hadamard gate and its effect on $\|0\rangle$.	**2 Marks**	**L1**	**CO2**

Part B

Answer the Questions. **Total Marks 40M**

6.	**a.**	Explain the concept of a qubit in detail. Using the Bloch sphere representation, show how an arbitrary qubit state can be visualized. Discuss the significance of global and relative phase.	**10 Marks**	**L2**	**CO1**
		Or			

7.	**a.**	Compare classical bits and quantum bits with respect to information representation, parallelism, reversibility, and computational power. Justify why quantum computation can outperform classical computation for certain problems.	**10 Marks**	**L2**	**CO1**

8.	**a.**	Derive the measurement postulate of quantum mechanics and explain how measurement probabilities are computed. Illustrate with an example of measuring a qubit in computational and Hadamard bases.	**10 Marks**	**L3**	**CO1**
		Or			
9.	**a.**	Explain all five postulates of quantum mechanics relevant to quantum computing. Discuss how each postulate influences the design of quantum algorithms and quantum circuits.	**10 Marks**	**L2**	**CO1**

10.	**a.**	Consider a two-qubit quantum system. (a) Explain the concept of tensor product in multi-qubit systems. (b) Show mathematically how the state $\|01\rangle$ is represented. (c) Discuss why the state $(\|00\rangle + \|11\rangle)/\sqrt{2}$ cannot be written as a product state.	**10 Marks**	**L3**	**CO2**
		Or			
11.	**a.**	Explain the properties of single-qubit quantum gates. Discuss the importance of unitarity and reversibility with suitable mathematical justification.	**10 Marks**	**L4**	**CO2**

12.	**a.**	Design a quantum circuit to transform the input state $\|00\rangle$ into $\|\psi\rangle = (\|00\rangle - \|01\rangle + \|10\rangle - \|11\rangle)/2$. Explain the role of each gate used in the circuit.	**10 Marks**	**L4**	**CO2**
		Or			
13.	**a.**	Discuss the steps involved in designing a quantum circuit for a given problem. Explain the challenges involved in circuit depth, gate count, and error accumulation in practical quantum systems.	**10 Marks**	**L5**	**CO2**