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BTECH
(SEM VII) THEORY EXAMINATION 2023-24
QUANTUM COMPUTING

TIME: 3 HRS**M.MARKS: 100****Note:** 1. Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief.**

Q no.	Question	Marks
a.	What is superposition in the context of quantum computing?	2
b.	What distinguishes qubits from classical bits in terms of information representation?	2
c.	Explain quantum gates.	2
d.	What is the significance of quantum algorithms?	2
e.	List the basic components of a quantum computer.	2
f.	What is ion trap and describe its function.	2
g.	What is Quantum Noise?	2
h.	What are Distance Measures for Quantum Information?	2
i.	Define stabilizer codes in the context of quantum error correction.	2
j.	What is the Shor code, and what is its primary application in quantum computing?	2

SECTION B**2. Attempt any three of the following:**

a.	What are the underlying principles and computational models that define quantum computation?	10
b.	Discuss quantum gates and their role in quantum computation.	10
c.	Explain the concept of a harmonic oscillator quantum computer and its significance in quantum information processing.	10
d.	Explain the role of Markov processes in the manifestation of quantum noise. How do Markov processes influence the stability and reliability of quantum operations?	10
e.	Describe the methodologies and considerations involved in constructing quantum error-correcting codes.	10

SECTION C**3. Attempt any one part of the following:**

a.	Explore the significance and potential applications of quantum algorithms in solving computational problems more efficiently than classical algorithms.	10
b.	Discuss the foundational postulates of quantum mechanics, emphasizing their role in shaping our understanding of the quantum world.	10

4. Attempt any one part of the following:

a.	Explain the concept of quantum circuits and their role in implementing quantum algorithms.	10
b.	Discuss the significance of quantum speedup and provide examples of algorithms where quantum computers outperform classical computers.	10

5. Attempt any one part of the following:

a.	Give the overview of optical photon quantum computers, focusing on the role of optical cavity quantum electrodynamics.	10
b.	Discuss the role of nuclear magnetic resonance (NMR) in quantum computing.	10

6. Attempt any one part of the following:

a.	Explain the fundamental principles underlying quantum operations and their significance in quantum information processing? How do quantum operations manipulate quantum states?	10
b.	Discuss distance measures. How are these measures employed in quantum information processing tasks?	10

7. Attempt any one part of the following:

a.	Illustrate how stabilizer codes contribute to fault-tolerant quantum computation and its role in preserving quantum information.	10
b.	Compare and contrast Shannon entropy with Von Neumann entropy, emphasizing their significance in quantum information theory.	10

B.TECH.
(SEM VII) THEORY EXAMINATION 2022-23
QUANTUM COMPUTING

Time: 3 Hours**Total Marks: 100****Note:** Attempt all Sections. If require any missing data; then choose suitably.**SECTION A**

- 1. Attempt all questions in brief.** **2 x 10 = 20**
- Who is the father of Quantum Computing?
 - How Bit is different from Qubit?
 - Are Quantum gates Reversible or Irreversible?
 - What are the conditions for Quantum Computation?
 - What is Nuclear Magnetic Resonance?
 - Can Quantum computers become Self aware?
 - Write any One characteristic of Markov Process.
 - Write any 3 Quantum Operations.
 - Is Shannon entropy positive or negative?
 - Define Shor Code.

SECTION B

- 2. Attempt any three of the following:** **10x3 = 30**
- Why are we so interested in Quantum Computers and Quantum Simulators in current time-period?
 - What hurdles do researches face in developing a Quantum Computer?
 - What is entanglement in Quantum Computing?
 - What is quantum electrodynamics? Why it is important in Quantum computing?
 - With the help of an example explain error correction with reference to Quantum Computing.

SECTION C

- 3. Attempt any one part of the following:** **10x1 = 10**
- What are the 3 key attributes to measure the performance of Quantum Computers?
 - Differentiate between classical computing and Quantum computing.
- 4. Attempt any one part of the following:** **10x1 = 10**
- What are the Universal Quantum Gates? Explain in detail.
 - Is there any application for why to search through an unstructured database, the average number of check is $N/2$ in classical computation?
- 5. Attempt any one part of the following:** **10x1 = 10**
- How do Photon Quantum Computers work?
 - What are the 3 types of Quantum Computer? Explain in detail.
- 6. Attempt any one part of the following:** **10x1 = 10**
- What types of problem are best suited for Quantum Computing?
 - How does Quantum Noise appear on a digital image? Explain in detail.
- 7. Attempt any one part of the following:** **10x1 = 10**
- What is Quantum error correction code? Explain.
 - What is Stabilizer Code?