



HALDIA INSTITUTE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION UNDER MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL)

Paper Code: MCS-PE 205E

Paper Name: Quantum Computing

Time Allotted: 3 Hours

Full Marks: 70

The figures in the margin indicate full marks

Candidates are required to give their answers in their own words as far as practicable

Group – A

(Multiple Choice Type Questions)

Choose the correct alternatives from the followings:

10x1=10

1. (i) What is quantum computing ?

- a) Quantum computing is an old technology used in computation.
- b) Quantum computing used in computation to solve certain physics problems only.
- c) Quantum computing is the phenomena of quantum mechanics in computation to solve certain problems.
- d) None of the Above

(ii) Who is the father of quantum computing?

- a) Isaac Chuang b) Neil Gershenfeld c) Philip Glass d) David Deutsch

(iii) In quantum computing, what is the basic unit of information?

- a) giga b) qubit c) bit d) byte

(iv) _____ is the point at which a quantum computer can complete a mathematical calculation that is demonstrably beyond the reach of even the most powerful supercomputer.

- a) Quantum energy b) Quantum entanglement
- c) Quantum supremacy d) None of the above

(v) In Quantum circuit, a memory consisting of n bits of information has _____ possible states.

- a) $2n$ b) $n \times n$ c) n d) 2^n

(vi) How will quantum computing affect artificial intelligence applications?

- a) Artificial Intelligence will evolve to become self-aware.
- b) Artificial intelligence will instantly solve optimization problems.
- c) Bias in machine learning will be completely eliminated.
- d) Machine learning algorithms will become much faster.

(vii) Which term describes the action of a qubit that moves from superposition to 1 or after measurement?

- a) collapse b) decryption c) switch d) optimization

(viii) Max Plank's great discovery was that radiation energy is emitted in packets that he called what?

- a) Photons b) Wave functions c) Gamma Rays d) Quanta

(ix) In the Heisenberg uncertainty principle, which two measurable properties of a particle cannot be observed precisely at the same time?

- a) Energy and Torque b) Spin and Colour
- c) Position and Momentum d) Size and Speed

(x) Some of the leading companies in the field Quantum Computing are _____

- a) IBM b) ION-Q c) Google d) All of the Above

Group – B
(Long Answer Type Questions)

Attempt any five from the followings:

5x12=60

2. i) Discuss about some real life application of Quantum Computing.
ii) What is Entanglement? Explain (8+4)
3. i) What is Hadamard Gate? Explain this Gate with different input values.
ii) Why Pouli X Gate is not a Universal Gate? ((2+5)+5)
4. i) Write a short note on Quantum Computing research.
ii) Briefly discuss about Heisenberg uncertainty principle. (6+6)
5. i) What is Fredkin Gate? Explain with truth table.
ii) Design a NOT Gate using Toffoli Gate. (6+6)
6. i) Construct Quantum NOR Gate with matrix implementation.
ii) What is density operator? Explain with example. (8+4)
7. i) Briefly discuss about Quantum Computing application in Genetic Programming.
ii) Write a short note on future scope of Quantum Computing. (6+6)
8. i) Briefly Explain on Quantum Circuit in series and Quantum Circuit in parallel.
ii) What is positive operator? (10+2)