

Total No. of Questions : 4]

PC-318

SEAT No. :

[Total No. of Pages : 2

[6361] - 190

**B. E. (Artificial Intelligence and Data Science) (In Sem.)**

**QUANTUM ARTIFICIAL INTELLIGENCE**

**(Elective - III) (2019 Pattern) (Semester - VII) (417523 A)**

*Time : 1 Hour]*

*[Max. Marks : 30*

*Instructions to the candidates:*

- 1) *Solve questions Q.1 or Q.2, Q.3 or Q.4.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*

**Q1) a)** Discuss single qubit gates in quantum computation, and how do they operate on qubits? [5]

- b)** Describe Qubit copying circuit in detail. [5]
- c)** Explain tensor product of two vector spaces, and how is it used in quantum mechanics? [5]

OR

**Q2) a)** Discuss Quantum circuits, and how are they used to manipulate qubits? [5]

- b)** Explain Bell states, and their importance in quantum information processing. [5]

**P.T.O.**

- c) Consider the vectors in Hilbert spaces [5]

$$a = \begin{bmatrix} 2 \\ 1 \\ 0 \end{bmatrix} \& b = \begin{bmatrix} 1 \\ -1 \\ 3 \end{bmatrix}$$

Evaluate : i) Inner product of two real vectors  $\langle a, b \rangle$   
ii) Norm  $\|a\|$

**Q3)** a) Explain Time-Evolution of a Closed Quantum System in detail. [5]

- b) Describe the Universal sets of quantum gates and its importance in quantum computing. [5]
- c) Explain in detail Quantum Fourier Transform is used in phase estimation. [5]

OR

**Q4)** a) Explain Mixed States and General Quantum Operations. [5]

- b) Discuss Quantum entanglement in detail. [5]
- c) Describe General application of Quantum Fourier Transform. [5]

