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Subject Code:- CCS0202

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: II - THEORY EXAMINATION (2025- 2026)

Subject: Introduction to Quantum Computing

Time: 2 Hours **Max. Marks: 50**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. *This Question paper comprises of* ***three Sections -A, B, & C.*** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. *Maximum marks for each question are indicated on right -hand side of each question.*

3. *Illustrate your answers with neat sketches wherever necessary.*

4. *Assume suitable data if necessary.*

5. *Preferably, write the answers in sequential order.*

6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

SECTION-A 15

1. Attempt all parts:-

(1.1) In complexity, O(n) means: (CO1, K1) 1

- (a) Constant time
- (b) Linear time
- (c) Quadratic time
- (d) Exponential time

(1.2) The mathematical notation for a state vector is a----. (CO3, K1) 1

- (a) Ket notation
- (b) Table notation
- (c) Stack notation
- (d) Loop notation

(1.3) In Qiskit, qc.measure() is used to __________. (CO4, K2). 1

- (a) Apply a gate
- (b) Initialize state
- (c) Perform measurement
- (d) Visualize

(1.4) Physical qubits must be kept __________ to minimize noise. (CO3, K1) 1

- (a) Hot
- (b) In superposition
- (c) Measured
- (d) Cold

(1.5) Quantum hardware is susceptible to __________. (CO4, K1) 1

(a) Environmental noise
(b) Software bugs
(c) Fast decoherence
(d) Slow initialization

2. Attempt all parts:-

(2.1)	Enlist purpose of complexity classes. (CO1, K2)	2
(2.2)	Explain the postulate related to state evolution in quantum mechanics. (CO3, K2)	2
(2.3)	Explain state collapse with an example using $\|+\rangle$ state. (CO4, K2)	2
(2.4)	Explain the difference between classical and quantum gates using examples. (CO2, K2)	2
(2.5)	Give one example of a practical problem where quantum advantage is sought. (CO5, K2)	2

<u>SECTION-B</u> 15

3. Answer any <u>three</u> of the following:-

(3.1)	Explain how the development of microprocessors led to the rise of personal computing. (CO2, K2)	5
(3.2)	Explain the relationship between observables and measurement outcomes in a quantum system. (CO3, K2)	5
(3.3)	Write the limitations and advantages of the no-cloning theorem in practical quantum systems. (CO3, K2)	5
(3.4)	Model how the quantum entanglement simulate the teleportation? Explain its importance in information exchange with example. (CO4, K3)	5
(3.5)	Assess how industry leaders are approaching the development of quantum computing technology. (CO5, K5)	5

<u>SECTION-C</u> 20

4. Answer any <u>five</u> of the following:-

(4.1)	Discuss the structure and function of the ALU. (CO2, K2)	4
(4.2)	Compare the four stages of the instruction cycle. (CO1, K4)	4
(4.3)	Define quantum parallelism. Give an example of how it allows computation on multiple states simultaneously. (CO3, K2)	4
(4.4)	Apply a Qiskit code snippet to create and initialize a single qubit in $\|0\rangle$ and $\|1\rangle$ states. (CO4, K3)	4
(4.5)	Compare the Deutsch-Jozsa and Grover's Search algorithms in terms of purpose and efficiency. (CO5, K4)	4
(4.6)	Discuss the role of quantum simulation in drug discovery and material science. (CO5, K2)	4
(4.7)	Suggest possible future directions for quantum computing research and industry applications. (CO5, K2)	4
(4.8)	Define a qubit and explain its mathematical representation. (Co3, K2)	4