List of Project Titles

1. Introduction to Quantum Gates: Building Basic Quantum Circuits

- Briefly introduction about quantum bits, quantum gates, and quantum circuits
- Design simple quantum circuits using basic quantum gates (Hadamard, CNOT, Pauli-X) and observe their behavior, focusing on superposition and entanglement.
- Write Python code to execute the quantum circuits and summarize the result

2. Simulating a Quantum Qubit System: Exploring Superposition and Measurement

- Briefly introduction about multiple qubits, quantum gates, and quantum circuits
- A project that simulates a multiple qubits in superposition,
- Demonstrating how quantum measurements collapse states and affect probabilities.
- Write Python code to execute the quantum circuits and summarize the result

3. Quantum Bits vs. Classical Bits: A Comparative Study

- Compare and contrast the fundamental differences between qubits and classical bits, focusing on properties like superposition and entanglement.

4. Simulating the Deutsch Algorithm: An Introduction to Quantum Speedup

- Implement the Deutsch algorithm and explain how quantum computers can outperform classical computers in solving certain problems.

5. Basic Quantum Circuit Simulation Using Qiskit

- Using IBM's Qiskit framework, you can simulate simple quantum circuits and run them on real or simulated quantum hardware, gaining hands-on experience.

6. Bell's Theorem: Simulating Quantum Entanglement

- Explore quantum entanglement by simulating Bell's Theorem and understanding its implications for quantum physics and computing.

7. Quantum Key Distribution: A Simple BB84 Protocol Simulation

- Implement a basic version of the BB84 protocol, which introduces you to quantum cryptography and the concept of quantum-secure communication.

8. Visualizing Quantum States: Bloch Sphere Representation of Qubits

- Create visual representations of qubits on the Bloch Sphere, explaining how quantum states evolve and how measurements affect them.

9. Exploring Quantum Superposition: Double-Slit Experiment Simulation

- Simulate a quantum double-slit experiment and explain how quantum superposition leads to interference patterns, comparing this to classical particle behavior.

10. Basic Quantum Error Correction: Simulating a Three-Qubit Bit-Flip Code

- Introduce the concept of quantum error correction by simulating a simple three-qubit bit-flip error-correcting code and explaining how it works.