**How to Structure Your Work Throughout the Semester**

**1. Foundations (Weeks 1-6) → “Survey of Quantum Neural Networks”**

📌 **Goal:** Build a strong theoretical foundation for QNNs.  
✅ Research the history, fundamental principles, and types of QNNs.  
✅ Identify key papers, researchers, and ongoing work in QNNs.  
✅ Compare QNNs and classical neural networks at a high level (not performance-based, but conceptually).  
✅ Output: A **technical survey paper** + **presentation** explaining the fundamentals.

**2. Explorations (Weeks 7-10) → “Technical Analysis of QNNs”**

📌 **Goal:** Analyze a **specific** technical component of QNNs.  
✅ Pick a narrow focus area (e.g., training methods, hardware requirements, expressiveness).  
✅ Conduct a deeper dive into the mathematical and algorithmic aspects.  
✅ If possible, run a simple experiment using a QNN simulator (e.g., Qiskit, PennyLane).  
✅ Output: A **technical analysis report** + **presentation** demonstrating understanding.

**3. Futures (Weeks 11-13) → “Future Trends in QNNs”**

📌 **Goal:** Predict upcoming developments and challenges.  
✅ Research industry and academic trends (IBM, Google, Microsoft, etc.).  
✅ Analyze scalability issues, hybrid quantum-classical approaches, and near-future applications.  
✅ Look at expert opinions and market trends for QNNs in AI.  
✅ Output: A **future trends paper** discussing where the field is headed.

**4. State of the Field (Final Weeks) → “Synthesizing Everything”**

📌 **Goal:** Combine all research into a **comprehensive report and presentation.**  
✅ Refine earlier reports and integrate them into a unified paper.  
✅ Prepare a final **presentation** to explain your work to a general audience.  
✅ Include a short demo if possible (even a simulation or visualization of QNNs).  
✅ Output: **Final report + polished presentation** to showcase your expertise.

1. **Survey of Quantum Neural Networks**

* Explore the history, foundational concepts, and recent advances in QNNs.
* Compare various architectures of QNNs (e.g., Variational Quantum Circuits, Quantum Convolutional Networks).
* Summarize key breakthroughs and limitations in QNN development.

2. **Technical Analysis: How QNNs Differ from Classical Neural Networks**

* Instead of a broad comparison (which lacks research), focus on one specific aspect, such as:
  + **Training methodologies** (gradient descent in QNNs vs. classical approaches).
  + **Hardware constraints** (quantum hardware limitations vs. GPU/TPU acceleration).
  + **Expressiveness and computational efficiency** (where QNNs might offer advantages).
* This would give a solid technical foundation for your project.

3. **Future Trends in QNN Research and Applications**

* What are the upcoming developments in QNNs over the next 6-12 months?
* Industry adoption: Are companies like IBM, Google, or Microsoft investing in QNNs?
* What challenges need to be solved before QNNs can compete with classical networks?

4. **Demonstration: Prototyping or Simulating a QNN**

* Use simulators like Qiskit (IBM) or PennyLane (Xanadu) to implement a small-scale QNN.
* Compare the performance of your QNN to a classical NN on a simple problem (e.g., XOR classification).