Week 1:

Summary

Chapter 1:

I first started with the introduction of a qubit. Qubit was introduced a s a vector in 2 D vector space. Qubits can be considered analogous to various other systems such as polarisation of photon, 2 energy states of an electron, alignment of nuclear spin in a uniron magnetic field etc.

Then, I moved on to general bra-kept notation of a qubit and studied about its Bloch sphere representation, Bloch vectors. The general principle of quantum mechanism was reiterated that the global phase of the qubit has no physical observable outcomes hence could be neglected in the Bloch sphere representation.

Then, intrigued by idea like superposition,amplitude,phases of qubits and their similarity with the behaviour of photons, I searched and read more about their analogy, how photons behave and thus gained more insight and 'feel' of qubits. Then , I moved on to read about superposition of qubits starting with 2 qubits. I studied about their normalisation, measurement, 2 state basis etc and also the very important 2 qubit entangled states 'bell states' which are a key ingredient in quantum teleportation and super dense coding. Then , I encountered the multiple qubit states, read about Hilbert spaces, tensor products and a detailed comparison between quantum and classical computers. Then , came the very important result and its proof that was given as an exercise that 'an operator(alias matrix) preserves length iff it is unitary' and thus as all unitary matrixes are invertible also and hence the only condition on quantum gates it that they should be unitary operators. After that, I studied about the various 2 qubit gates Pauli gates and h and I tried to comprehend them as rotation about axes on the Bloch sphere which was given as an additional note there After that , I moved on to study about 2 qubit gates from a single qubit gates starting with the C Note gate.

Then, came the no cloning theorem and general qc circuit symbols.

After this, I studied about the first proper qc algorithm 'quantum teleportation' which was an exciting experience As all classical circuits can be represented by the use of NAND gates only and qc ha the analogous Toffoli gates therefore with the use of 'ancilla bits' it was possible to simulate any classical circuit as quantum circuit.
The next and final highlight of chapter was quantum parallelism and the Deutch-Jozha algorithm

Chapter 2:

Chapter 2 focussed on learning about the mathematical formulations and revisiting linear algebra topics. General notations were revised, preliminaries were discussed. Then I learnt about Pauli matrices, inner products, outer products, bra-Ket notation and the very important completeness relation, its application, Cauchy Schwartz inequality, diagonal representation of matrices, adjoints, Hermitian products, projectors . After that, came the very important 'spectral decomposition theorem' which is heavily used in quantum circuit formulations, tensor products, Kronecker products, positive operator, positive operator etc.

Then, we studied about the postulates of quantum mechanics and again came back to discussing linear algebra, Hermitian matrices, trace as inner products, Hilbert space , Hilbert-Schmidt inner product operation, Commutator,Anti-Commutator,simuatanous diagonalisation theorem, single value decomposition did polar decompositions.