## Paper-IV

## Quantum Computation and Quantum Information

### Unit-1: Introduction

Review of quantum mechanics – Measurements – Density operator – Schmidt decomposition – Gleason's theorem – Ambiguity of the ensemble interpretation – The Kraus representation theorem.

### Unit-2: Quantum Computation

Classical computation – Turing machine – Circuit model of computation – Computational Complexity– Computing dynamical system – Quantum gates and circuits – Adiabatic quantum computation – Cluster state quantum computing – Conditions for computation.

### Unit-3: Quantum Entanglement

EPR paradox – Local hidden variable theory – Bohm's experiment – Bell's inequality – Entanglement in bipartite and multipartite states – Classical and quantum correlation – Nonlocality – Separability.Vs.Entanglement – CHSH inequality.

### Unit-4: Quantification of Entanglement

LOCC operation – Distillable entanglement – Entanglement of formation – Entropy of entanglement – Concurrence – Logarithmic negativity – Geometric measure of entanglement – Quantum discord.

### Unit-5: Quantum Information

Classical noise and Markov processes – Quantum noise and examples – Introduction to quantum error-correction – Fault-tolerant quantum computation – Shannon entropy – Basic properties of entropy –Von Neumann entropy.

**References:**


1. M.A.Neilsen, I.L Chuang, Quantum Computation and Quantum Information, Cambridge University Press, Cambridge (2000).
2. J.Preskill, Lecture notes for Physics, Quantum computation (1999). http://theory.caltech/edu/~preskill/ph229.
3. A.Peres, Quantum theory: Concepts and Methods, Kluwer Academic publishers, New York (2002).
4. R.Horodecki, P.Horodecki, M.Horodecki, K.Horodecki, Rev. Mod Phys. 81, 865 (2009).




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