COMPUTATIONAL BASICS FOR QUANTUM COMPUTATION

Unit 1: Vector Spaces and Linear Equations – Vector Spaces and Subspaces, The solution of m Equations in *n* Unknowns, Linear Independence, Basis, Dimension, The Four Fundamental Subspaces, Networks and Incidence Matrices, Linear Transformations

Unit 2: Orthogonality – Orthogonal Subspaces, Inner Products and Projections Onto Lines, Orthogonal Bases, Orthogonal Matrices, and Gram-Schmidt Orthogonalization; Eigen values an Eigenvectors – The Diagonal Form of a Matrix, Similarity Transformations

Unit 3: Hermitian operators; tensor products; the commutator and anti-commutator; the pola and singular value decompositions

Unit 4: The postulates of quantum mechanics – state space; evolution; quantum measuremen distinguishing quantum states; projective measurements; POVM measurements; phase; composite systems

Unit 5: Application: superdense coding; the density operator – ensembles of quantum states; general properties of the density operator; the reduced density operator; the schimdt decomposition and purifications; EPR and Bell inequality

Books and References:

1. Strang, Gilbert. *Linear Algebra and its applications.* Brooks Cole, 4th edition.
2. P.M. Mathews and K. Venkatesan, *A Textbook of Quantum Mechanics*, Tata McGraw-Hill (1977).
3. J.L. Powell and B. Crasemann, *Quantum Mechanics*, Narosa Publishing House (1993).
4. J.J. Sakurai, *Modern Quantum Mechanics*, Addison-Wesley (1999).

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