Problems to Chapter 2 – Introduction to Quantum Mechanics

1. Linear algebra – vectors, addition, multiplication by scalar.
2. Basic notation of quantum mechanics
3. Linearly dependent and independent vectors
4. Linear operators
5. Linear operators as Matrices
6. The Pauli Matrices
7. Inner products and orthogonal vectors.
8. Orthonormal vectors.
9. Gram-Schmidt Procedure
10. Outer Product and Completeness Relation
11. Cauchy-Schwarz inequality
12. Eigenvectors and eigenvalues
13. Characteristic function
14. Determinant
15. Diagonal representation for an operator
16. Orthonormal decompositions
17. Adjoints and Hermitian Operators
18. Tensor Products
19. The spectral decomposition
20. Operator functions, trace
21. The Commutator and anti-commutator
22. Simultaneous Diagonalization Theorem
23. The polar and singular value decompositions
24. The postulates of quantum mechanics: (1) State Space, (2) Evolution, (3) Quantum Measurement, (4) Distinguishing quantum states
25. Projective measurements
26. The Heisenberg Uncertainty Principle
27. POVM Measurements
28. Phase
29. Composite Systems
30. Superdense Coding
31. The Density Operator and its properties
32. Ensambles of Quantum States
33. EPR and Bell Inequality