Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NECD505	Quantum Computation	3	0	0	3

Course Objective
The objective of the course is to develop an understanding of the basic principles, techniques and applications of quantum computation.
Learning Outcomes
Upon successful completion of this course, students will: • Understand the concept of quantum computing • Acquire an understanding of essential aspects of quantum mechanics • Get a knowledge of qubits, quantum logic gates, quantum algorithms and implementation • Know about the physical implementation of quantum computers

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Introduction to quantum computation; Historical perspectives, Quantum bits, Quantum algorithms.	3	Acquire a basic understanding of the main concepts of the field
2	Introduction to quantum mechanics, Linear Algebra, Linear operators and matrices, Tensor product, Postulates of quantum mechanics, Density operator, Quantum measurement, Quantum entanglement, EPR and Bell's inequality	8	Develop the necessary background knowledge of quantum mechanics needed for a thorough grasp of quantum computation
3	Quantum circuits, No-cloning theorem, Quantum teleportation, Single qubit operations, Controlled operations, Measurement, Universal quantum gates, Quantum circuit model of computation, Simulation of quantum systems	8	Understand the fundamental principles of quantum computation, and establish the basic building blocks for quantum circuits
4	Quantum Algorithms, Introduction. Quantum Parallelism. Deutsch's Algorithm. Deutsch-Jozsa Algorithm, Quantum search algorithms	7	Develop an understanding of quantum algorithms and the underlying techniques
5	Quantum Fourier transform. Quantum circuit for quantum Fourier transform. Quantum phase estimation. Factorization algorithms, General Applications of quantum Fourier transforms	7	Develop quantum Fourier transform, which is the key ingredient for quantum factoring and many other interesting quantum algorithms
6	Physical realisation of quantum computation, Harmonic oscillator quantum computer, Optical photon quantum computer. Solid-state quantum computer	4	Study the physical implementation of quantum computing devices
7	Quantum information, Entropy, Quantum noise and quantum operations, Quantum error-correction	5	Acquire basic knowledge about quantum information
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Textbook:

4. Michael A. Nielsen and Issac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 2010.

Reference Books:

4. N. David Mermin , Quantum Computer Science: An Introduction, Cambridge University Press (2007).
5. Phillip Kaye, Raymond Laflamme, Michele Mosca, An Introduction to Quantum Computing, Oxford University Press, 2007.
6. A. Kitaev, A. Shen, M. Vyalyi, Classical and Quantum Computation, American Mathematical Society, 2002.