



Birla Institute of Technology & Science, Pilani

Hyderabad Campus

I SEMESTER 2023 - 2024

COURSE HANDOUT

Date:11-08-2023

In addition to part I (General Handout for all courses appended to the timetable), this portion gives further specific details regarding the course.

Course No. : BITS F386

Course Title: Introduction to Quantum Information and Computation

Instructor-in-charge: T S L Radhika

Scope & Objective of the course: This course is an elementary introduction to a new and frontier multidisciplinary field of quantum computation and quantum information. This subject is of common interest to physics, computer science, mathematics, and engineering students. It introduces the concept of information in a physical sense and how quantum physics becomes important in its realization. The course introduces the basic ideas of quantum mechanics relevant to the presentation of information in terms of qubits and how this information can be processed (computed) and transmitted.

Text Book: Quantum Computation and Quantum Information, M A Nielsen and I L Chuang, CAMBRIDGE, 2013.

Reference Books:

1. Principles of Quantum Computation and Information, V.1, Benenti, Casati and Strini, World Scientific, 2004.
2. Online lecture notes by Mark Oskin:
<https://homes.cs.washington.edu/~oskin/quantum-notes.pdf>
3. Online lecture notes by John Preskill:
<http://www.theory.caltech.edu/people/preskill/ph229/>

Course Plan:

Lecture Number	Lecture Objectives	Topics to be covered	Chapter in the Text Book
1-3	To learn the concepts of Quantum Computing	Fundamental concepts, Quantum bits, Quantum information	1.1, 1.2, 1.6,
4-10	To study the pre-requisites and fundamentals of Quantum Mechanics	Quantum computation, Linear algebra, Postulates of Quantum Mechanics	1.3 (1.3.1-1.3.3), 2.1, 2.2



11-17	To understand Quantum circuits	Quantum Gates: single qubit, multiple qubit gates, Controlled gates, Universal Gates, Measurement, Bell states.	1.3 (1.3.4-1.3.6), Ch 4
18-23	To learn Quantum Algorithms	Quantum Teleportation, Quantum parallelism, Deutsch's algorithm, Deutsch-Jozsa algorithm	1.3.7, 1.4
24-28	To study Quantum Fourier Transform	Quantum Fourier Transform and its Applications	Ch 5
29-32	To learn Quantum algorithms (contd.)	Shor's Algorithm, Grover's Algorithm	Oskin, Lecture Notes
33-36	To understand Quantum noise, Error correction	Quantum operations, Error correction, Coding	8.2, 8.3, 10.1, 10.3, 10.4
37-40	To study Quantum Cryptography	Quantum Cryptography	12.6

Evaluation Scheme:

EC No.	Evaluation Component	Duration	Weightage (%)	Date, Time	Remarks
1	Assignment -1		10	Take Home	Open Book
2	Assignment -2		10	Take Home	Open Book
3	Project and Viva		15		Open Book
3	Mid-Sem		30	11/10 - 4.00 - 5.30PM	Closed Book
4	Comprehensive		35	13/12 AN	Closed Book

Chamber consultation hour: To be announced in the class.

Make-up Policy: Make-up will be given only for genuine cases, and prior permission must be obtained from the I/C.

Notices: The notices concerning this course will be displayed on the CMS only.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester, and no type of academic dishonesty is acceptable.

Instructor-in-Charge

BITS F386

