

Course Syllabus

Course Information

Course Number: CS 6301.001
Course Title: Special Topics in Computer Science – Quantum Computing
Term: Spring 2025
Location: HH 2.502
Days & Times: MW 4:00 PM – 5:15 PM

Professor Contact Information

Instructor: Dr. Andrew Nemec
Office: ECSS 4.212
Email: andrew.nemec@utdallas.edu
Office Hours: MW 2:00 PM – 3:00 PM or by appointment

Course Pre-requisites, Co-requisites, and/or Other Restrictions

Prerequisites: MATH 2418, ENGR 2300, or equivalent linear algebra course with C or better

Course Description

Introduction to the mathematical formalism of quantum mechanics. Design and analysis of quantum circuits and implementation of quantum programs. Analysis of elementary quantum algorithms including quantum search, quantum Fourier transform, and phase estimation. Current limitations of quantum computing and techniques for overcoming these limitations will also be covered.

Student Learning Objectives/Outcomes

By the completion of this course students should:

1. Understand and be able to utilize the mathematical formalism needed for quantum computing.
2. Understand the elementary postulates of quantum mechanics.
3. Understand the quantum circuit model, elementary quantum gates, and analyze the behavior of quantum circuits.
4. Have knowledge of elementary quantum algorithms including quantum search, the quantum Fourier transform, and phase estimation.
5. Have knowledge of the current challenges and limitations of quantum computing and techniques for overcoming them.

6. Have experience implementing quantum algorithms in a quantum programming language.

Course Materials

The required course textbook is:

- Michael A. Nielsen and Isaac L. Chuang, “Quantum Computing and Quantum Information:10th Anniversary Edition,” Cambridge University Press, ISBN 978-1-10700-217-3

A suggested textbook is:

- Phillip Kaye, Raymond Laflamme, and Michele Mosca, “An Introduction to Quantum Computing,” Oxford University Press, ISBN 978-0-19-857049-3

Assignments & Academic Calendar

Homework assignments will be assigned roughly biweekly. A group project will be assigned after spring break, with presentations during the final two weeks of class.

There will be one exam:

- Midterm Exam: **Wednesday, March 12** in class.

Below is a tentative schedule, as the dates are subject to change at the discretion of the instructor. An up-to-date schedule may be found on eLearning.

Week	Lecture Dates	Topics
1	Jan. 20 Jan. 22	MLK Day (No Class) Overview, Linear Algebra Review
2	Jan. 27 Jan. 29	Linear Algebra Review Probability Theory Review
3	Feb. 3 Feb. 5	Probabilistic Algorithms Postulates of Quantum Mechanics
4	Feb. 10 Feb. 12	Postulates of Quantum Mechanics Models of Computation
5	Feb. 17 Feb. 19	Quantum Circuits
6	Feb. 24 Feb. 26	Elementary Quantum Algorithms
7	Mar. 3 Mar. 5	Universal Gate Sets Grover's Algorithm
8	Mar. 10 Mar. 12	Grover's Algorithm Midterm Exam

9	Mar. 17 Mar. 19	Spring Break (No Class)
10	Mar. 24 Mar. 26	Quantum Fourier Transform
11	Mar. 31 Apr. 2	Phase Estimation
12	Apr. 7 Apr. 9	Deutsch-Jozsa Algorithm Simon's Algorithm
13	Apr. 14 Apr. 16	Shor's Algorithm
14	Apr. 21 Apr. 23	Quantum Error Correction
15	Apr. 28 Apr. 30	Presentations
16	May 5 May 7	Presentations

Grading Policy

The final grade earned will be a weighted average of the following categories:

Homework Assignments	20%
Group Project	40%
Midterm Exam	40%
Total	100%

The letter grade corresponding to the final grade G will be assigned according to:

		$G \geq 93$	A	$93 > G \geq 90$	A-
$90 > G \geq 87$	B+	$87 > G \geq 83$	B	$83 > G \geq 80$	B-
$80 > G \geq 77$	C+	$77 > G \geq 70$	C	$70 > G$	F

Course & Instructor Policies

Class Attendance: Attendance will be taken the first week of class for university purposes. Regular and punctual class attendance is expected, though not mandatory, for lectures. Students who fail to attend class regularly are inviting scholastic difficulty. Students who miss class are responsible for learning course materials that they missed. If you do arrive late to class, please be courteous to the other students and enter the room quietly. Attendance for exams is mandatory, unless excused.

- Make-up Exams:** The midterm exam missed for an excused absence will ideally be made up within a week of the exam at a time acceptable to all students requiring a makeup exam. Please contact the instructor ahead of time if possible. An unexcused absence from a midterm exam will result in a score of 0.
- Assignments:** All assignments should be typeset in LaTeX unless otherwise noted in the instructions.
- Late Work:** A penalty of 10% will be applied to all assignments turned in late up to 48 hours after the deadline. Assignments turned in after this will not be accepted without prior approval of the instructor.
- Regrade Requests:** If you believe that a particular problem on an assignment or exam has been incorrectly graded, please email the instructor within a week of the assignment or exam being returned explaining why it is incorrect. If the score was incorrectly calculated, please contact the instructor before the end of the semester.
- Accommodations:** If you require a reasonable accommodation for an exam, please provide a written document from the AccessAbility Resource Center (ARC) at least one week prior to the exam.
- Plagiarism:** All students are expected to turn in their own work. Any outside sources other than the instructor and textbooks must be cited. If you worked with a fellow student, make sure to include their name in your citations. Text or code that has been copy-pasted from an outside source, including AI generated materials, will be considered plagiarism and will be reported to the Office of Community Standards and Conduct.
- Email:** All official correspondence with the instructor should be done using the student's official UT Dallas email address. Please make sure to include your name, course, and section in any email.

Class Materials

The instructor may provide class materials that will be made available to all students registered for this class as they are intended to supplement the classroom experience. These materials may be downloaded during the course; however, these materials are for registered students' use only. Classroom materials may not be reproduced or shared with those not in class or uploaded to other online environments except to implement an approved AccessAbility Resource Center

accommodation. Failure to comply with these University requirements is a violation of the [Student Code of Conduct](#).

Class Attendance

The University's attendance policy requirement is that individual faculty set their course attendance requirements. In some courses, instructors may have special attendance requirements; these should be made known to students during the first week of classes.

Class Participation

Regular class participation is expected. Students who fail to participate in class regularly are inviting scholastic difficulty. It also includes engaging in group or other activities during class that solicit your feedback on homework assignments, readings, or materials covered in the lectures (and/or labs). Successful participation is defined as consistently adhering to University requirements, as presented in this syllabus. Failure to comply with these University requirements is a violation of the [Student Code of Conduct](#).

Class Recordings

Students are expected to follow appropriate University policies and maintain the security of passwords used to access recorded lectures. Unless the AccessAbility Resource Center has approved the student to record the instruction, students are expressly prohibited from recording any part of this course. Recordings may not be published, reproduced, or shared with those not in the class, or uploaded to other online environments except to implement an approved AccessAbility Resource Center accommodation. Failure to comply with these University requirements is a violation of the [Student Code of Conduct](#).

The instructor may record meetings of this course. These recordings will be made available to all students registered for this class if the intent is to supplement the classroom experience. If the instructor or a UTD school/department/office plans any other uses for the recordings, consent of the students identifiable in the recordings is required prior to such use unless an exception is allowed by law.

Classroom Citizenship

Students are encouraged to ask questions during the lecture.

Students should be respectful of each other and the instructor both inside and outside the classroom.

Comet Creed

This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same:

“As a Comet, I pledge honesty, integrity, and service in all that I do.”

Accommodations for Students with Disabilities

Please review [the section](#) within the UT Dallas Syllabus Policies and Procedures webpage.

Academic Support Resources

Please visit the [Academic Support Resources](#) page to view the University’s academic support resources for all students.

UT Dallas Syllabus Policies and Procedures

Please visit the [Syllabus Policies](#) page to view the University’s policies and procedures segment of the course syllabus.

Please review the catalog sections regarding the [credit/no credit](#) or [pass/fail](#) grading option and withdrawal from class.

The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.