

MATH 4782 Syllabus

Quantum information & Quantum Computing, Section AG,AU,Physics, 3 credit hours

Fall 2026

Instructor Information

Instructor: Dr. Federico Bonetto

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General Course Information

Description

The course is designed for a broad range of students who have in common a strong mathematical preparation. Quantum information and computing have become important areas of scientific research and endeavor because of their potential applications in information processing systems and the security of communications. A quantum processor should take advantage of a key property absent in classical physics: entanglement. This course provides a first introduction to the ideas of quantum information by developing a set of quantum mechanical principles and tools, which are then applied to quantum computing and quantum information systems.

We will cover the following topics:

- Overview of Quantum Mechanics
- Classical and Quantum information: cbits vs qbits
- Quantum Gates
- Quantum Parallelism and important Quantum Algorithms
- Quantum Information: noise, entanglement and teleportation
- Basic Notions of Quantum Error Correcting Codes

Course Learning Outcomes

- Learn the basic principles of Quantum Mechanics with particular focus to their implication for systems of qbits.
- Gain familiarity with the most important Quantum gates and learn how to design and analyze Quantum Circuits
- Learn the most important Quantum Algorithm: Deutsch-Josza Algorithm, Quantum Fourier Transform
- Be exposed to the basic ideas of Quantum Information: Teleportation, Quantum Noise, Error Correcting Codes.

Prerequisites

MATH 2401 or MATH 2411 or MATH 24X1 or MATH 2551 or MATH 2561 or MATH 2X51.

Required Course Materials

Michael A. Nielsen and Isaac L. Chuang, *Quantum Computation and Quantum Information*, Cambridge University Press

Grading Policy

Grading for the course will be broken down as follows:

4 HW sets	5% each
2 Midterms	25% each
1 Final exam	30%

Grade Scale

A	100%-90%
B	89%-80%
C	79%-70%
D	69%-60%
F	<60%

Assignments

- Midterms, 50%
- HW sets, 20
- Final 30%

Description of Graded Components

- Midterms and Final: they will take place at 1/3, 2/3 and at the end of the semester. They will consist in 4 or 5 questions (possibly divided in more than one point). The midterm will be given in class during a full class period. They will be graded and returned the week after together with a solution set.
- HW sets: They will be due every ≈ 3 weeks. They will be posted on Canvas and consist of few selected exercises, mostly from the textbook, that I consider important to check that you are following along.

Course Policies

Attendance and Participation

This class is designed to encourage students to become active participants, so it's very important that all students attend each class session. Please attend every scheduled meeting on time. That said, if you are exhibiting any symptoms of illness (fever over 100.4 F, coughing, nausea, etc.), please stay home to rest, seek medical attention if appropriate, and contact me as soon as possible. Excessive lateness and absences can negatively impact your final grade outcome. If you have extenuating circumstances, I will try and work with you to address those challenges. Please communicate early and often if you are struggling with issues that may call for accommodations.

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review Georgia Tech's Honor Code and the student Code of Conduct.

Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.