

Introduction to quantum information

Lecturer: Tim Byrnes

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Syllabus

Lectures

Instructor: Tim Byrnes

Times: Tue 1:45-3pm, Thu 1:45-3pm

Location: Room 528

Recitations

None (problem sets will be done in class)

Office hours

Location: 1200

Times: Everyday 3:30-5:30

Contact for Tim Byrnes

Office: 1113

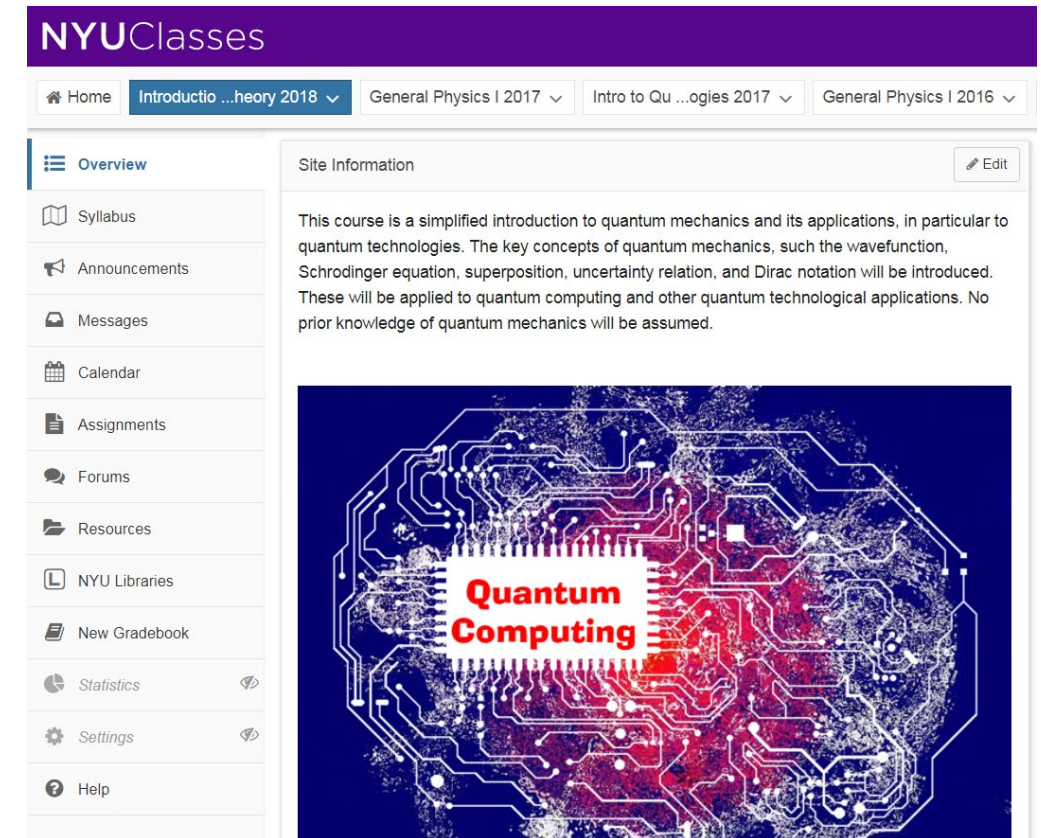
Email: tim.byrnes@nyu.edu

Course website

- URL: <https://newclasses.nyu.edu>
- Contains the syllabus, calendar, assignments, and other information relevant to the course.

Prerequisites

- Linear Algebra OR Honors Linear Algebra OR Linear Algebra and Differential Equations



The screenshot shows the NYUClasses website interface. At the top is a purple header with the "NYUClasses" logo. Below the header is a navigation bar with tabs for "Home", "Introductory Theory 2018", "General Physics I 2017", "Intro to Quantum Technologies 2017", and "General Physics I 2016". On the left side, there is a sidebar menu with the following items: Overview (selected), Syllabus, Announcements, Messages, Calendar, Assignments, Forums, Resources, NYU Libraries, New Gradebook, Statistics, Settings, and Help. The main content area is titled "Site Information" and contains a paragraph describing the course as a simplified introduction to quantum mechanics and its applications, specifically focusing on quantum technologies. It lists key concepts like the wavefunction, Schrodinger equation, superposition, uncertainty relation, and Dirac notation. Below the text is a large, stylized graphic of a quantum circuit with the words "Quantum Computing" in red text in the center.

Textbook

M. Nielsen and I. L. Chuang,

Quantum Computation and Quantum Information

ISBN: 978-1107002173

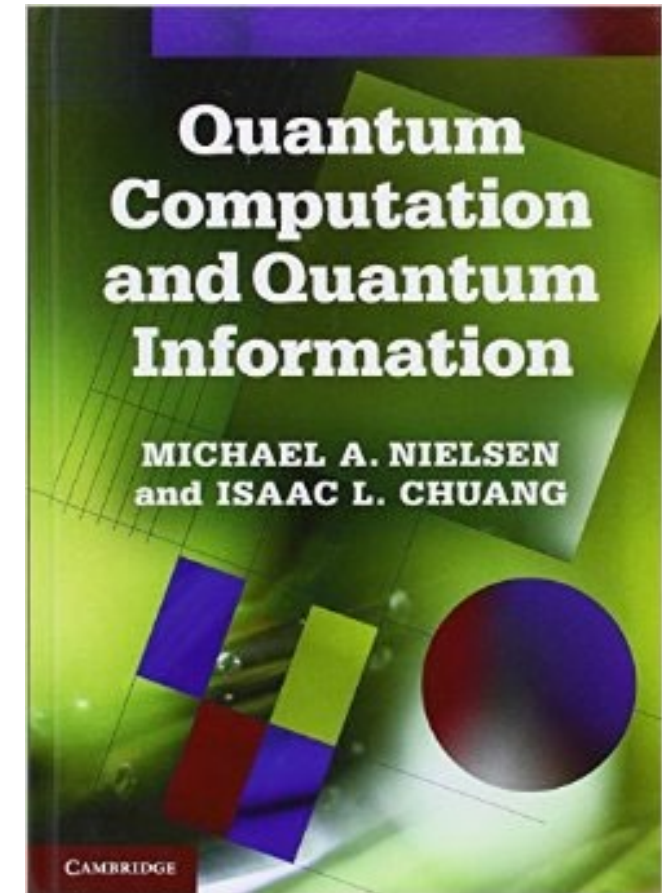
Supplementary texts:

David Griffiths,

Introduction to Quantum Mechanics, (2nd ed.)

ISBN: 0-13-191175-9

(see NYU Classes “Resources” section for relevant Sections)



Course Goals

To understand and be able to perform simple quantum mechanical calculations. To have a broad understanding of the field of quantum information technology and its potential applications.

Topics

- Historical introduction of quantum theory
 - Essential points of linear algebra and complex numbers
 - The quantum wavefunction
 - Time independent Schrodinger's equation
 - Time dependent Schrodinger's equation
 - Probabilistic interpretation
 - Operators expectation values
 - Matrix formulation of quantum mechanics
 - Physical implementation of quantum systems
 - Qubits and quantum gates
 - Quantum measurement
 - Quantum teleportation
 - Quantum cryptography: the BB84 protocol
 - Quantum metrology: NOON states and the Heisenberg limit
 - Quantum simulation
 - Quantum algorithms: Grover's algorithm
- (the above list is a guide only and subject to change depending on the progress of the lectures. Before each exam the precise scope will be specified)

Grading

- Midterm exam 30%
- Final exam 35%
- Homework 15%
- Assignment 20%

Notes

- Homework will be given during the lecture and is due the following lecture (see NYU Classes “Resources” section)
- Assignments will be open-ended topics that you investigate
- The assignment will be written up and handed in towards the end of semester

Course expectations and policies

Expectations

- Attendance for lectures and recitations is mandatory
- Students are expected to participate in class, and discuss ideas
- Students should do the homework before each class

Course policies

- The final scope of the course is specified before each exam. The lectures and recitations are to assist in your learning, and not for "covering" material.
- For any late work 5% of the mark will be deducted per day
- Breaches of academic integrity (i.e. plagiarism, cheating etc.) are taken very seriously
- Adjustments to this document may be made throughout the semester