SJSU SAN JOSÉ STATE UNIVERSITY

**Charles W Davidson College of Engineering · Electrical Engineering**

# Introduction to Quantum Computing

## EE 225

Fall 2025 Section 01 In Person 3 Unit(s) 08/20/2025 to 12/08/2025 Modified 08/07/2025

## Contact Information

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| Instructor: | Dr. Hiu Yung Wong |
| Office Location: | ENG 363 |
| Telephone: | 408-924-3910 |
| Email: | hiuyung.wong@sjsu.edu |
| Office Hours: | Mon: 9:00am-10:00am or by appointment<br>In-person or zoom. (see Canvas or email instructor for zoom link) |

## Course Description and Requisites

Basic linear algebra with an emphasis on quantum computing will be introduced followed by quantum gates and quantum algorithms such as Shori¿½s algorithm. Simulation and hardware implementation will be used to enhance the learning experience.ï¿½Requires a minimal background in linear algebra and quantum mechanics.

Prerequisite(s): Graduate standing or instructor approval.

Letter Graded

## Classroom Protocols

Students are required to be in class on time and no use of cell phone during the class.

# Course Learning Outcomes (CLOs)

Upon successful completion of this course, students will be:

CLO1: Able to describe the differences between quantum computing and classical computing

CLO2: Able to construct quantum circuits and perform simulations

CLO3: Able to trace and explain the evolution of each qubit in a quantum circuit

CLO4: Able to explain the underlying construction of the common quantum algorithms

# Course Materials

## Textbooks

- Introduction to Quantum Computing: From a Layperson to a Programmer in 30 Steps. Hiu Yung Wong, Springer International Publishing, Second Edition: 2023, https://doi.org/10.1007/978-3-031-36985-8. ISBN: 978-3-031-36984-1 **(Free download with SJSU VPN)**

- Hiu Yung Wong, Quantum Computing Architecture and Hardware for Engineers - Step by Step. Switzerland: Springer International Publishing, 2025. https://doi.org/10.1007/978-3-031-78219-0 **(Free download with SJSU VPN)**

Quantum Mechanics:

- Modern Quantum Mechanics, J. J. Sakurai and J.J. Napolitano, Cambridge University Press, 2017 (available as a print book in SJSU library).

Quantum Computing Theory and Algorithms:

- Quantum Computer Science: An Introduction, N.D. Mermin, 2016.
- Quantum Computation and Quantum Information: 10th Anniversary Edition, M. Nielson and I. Chang, Cambridge University Press, 2011 (available as a print book in SJSU library).

**Liaison librarian**: Yuqi He yuqi.he@sjsu.edu

# Course Requirements and Assignments

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| Prerequisites: | Graduate standing or instructor approval |

# Faculty Web Page and MYSJSU Messaging

Course materials such as syllabus, handouts, notes, assignment instructions, etc. on Canvas Learning Management System course login website. You are responsible for regularly checking with the messaging system through MySJSU on Spartan App Portal (or other communication system as indicated by the instructor) to learn of any updates. For help with using Canvas see Canvas Student Resources page.

# Course Requirements and Assignments

Students are expected to attend all classes and participate actively in the seminar, submit the assignments and project reports on time and attend the mid-term and final exams. Assignments and Project Reports must be submitted on time to receive full credit. Late submission of Assignments and Project Reports within 3 days after the due date will only receive half of the credits. No credits will be given after the late submission due date.

Review the following policy about your responsibility:

- Office of Graduate and Undergraduate Programs' Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/

"Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally three hours per unit per week) for instruction, preparation/studying, or course related activities, including but not limited to internships, labs, and clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus."

# Course Project

Students need to use python to write a quantum computer simulator.

# ✔ Grading Information

## Final Examination or Evaluation

Exams will be closed book. However, students are allowed to bring a calculator and a page of aid sheet. There will be no make-up exam and those absent will receive no credit. Students must write their answers clearly in an organized fashion. Further instructions will be provided during exams. The course is based on letter grading and grading percentage breakdown is as follow:

# Grading Information

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|---|---|
| Assignment | 30% |
| Midterm Exam | 20% |
| Final Exam | 20% |
| Project | 30% |

# Determination of Grades

- Every assignment has equal weight (totally 30% of the final score)
- Assignment and Project reports must be submitted on time to receive full credit. Late submission: Half of the credit will be given if submitted within 3 days after the due date. No credit will be given if submitted after late submission due date.

Grading Breakdown:

A = 100 to 93 points

A minus = 92 to 88 points

B plus = 87 to 84 points

B = 83 to 79 points

B minus = 78 to 75 points

C plus = 74 to 72 points

C = 71 to 69 points

C minus = 68 to 65 points

D plus = 64 to 62 points

D = 61 to 59 points

D minus = 58 to 55 points

F = 55 points or lower

EE Department Honor Code

The Electrical Engineering Department will enforce the following Honor Code that must be read and accepted by all students.

"I have read the Honor Code and agree with its provisions. My continued enrollment in this course constitutes full acceptance of this code. I will NOT:

- Take an exam in place of someone else, or have someone take an exam in my place
- Give information or receive information from another person during an exam
- Use more reference material during an exam than is allowed by the instructor
- Obtain a copy of an exam prior to the time it is given

- Alter an exam after it has been graded and then return it to the instructor for re-grading
- Leave the exam room without returning the exam to the instructor."

Measures Dealing with Occurrences of Cheating

- Department policy mandates that the student or students involved in cheating will receive an "F" on that evaluation instrument (paper, exam, project, homework, etc.) and will be reported to the Department and the University.

• A student's second offense in any course will result in a Department recommendation of suspension from the University.

# University Policies

Per University Policy S16-9 (PDF) (http://www.sjsu.edu/senate/docs/S16-9.pdf), relevant university policy concerning all courses, such as student responsibilities, academic integrity, accommodations, dropping and adding, consent for recording of class, etc. and available student services (e.g. learning assistance, counseling, and other resources) are listed on the Syllabus Information (https://www.sjsu.edu/curriculum/courses/syllabus-info.php) web page. Make sure to visit this page to review and be aware of these university policies and resources.

# Course Schedule

| Week | | Seminar | Assignment | Project |
|---|---|---|---|---|
| 1 | 19-Aug | No Class | | |
| | 21-Aug | Introduction | | |
| 2 | 26-Aug | Basic Mathematics and Quantum Mechanics | | |
| | 28-Aug | Basic Mathematics and Quantum Mechanics | | |
| 3 | 2-Sep | Basic Mathematics and Quantum Mechanics | | |
| | 4-Sep | Basic Mathematics and Quantum Mechanics | | |

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| 4 | 9-Sep | Basic Mathematics and Quantum Mechanics | | |
| | 11-Sep | Qubit and Entanglement | Assignment 1 due on 9/14 | |
| 5 | 16-Sep | Qubit and Entanglement | | |
| | 18-Sep | Quantum Gate | | |
| 6 | 23-Sep | Quantum Gate | | |
| | 25-Sep | Quantum Gate | Assignment 2 due on 9/28 | |
| 7 | 30-Sep | Quantum Gate | | |
| | 2-Oct | Quantum Circuit and Teleportation | | |
| 8 | 7-Oct | Quantum Circuit and Teleportation | | |
| | 9-Oct | Review | Assignment 3 due on 10/12 | |
| 9 | 14-Oct | Midterm | | |
| | 16-Oct | Deutsch's Algorithm | | |
| 10 | 21-Oct | Grover's Algorithm | | |
| | 23-Oct | Grover's Algorithm | | |
| 11 | 28-Oct | Quantum Fourier Transformation | | |
| | 30-Oct | Encryption and Shor's Algorithm | | |
| 12 | 4-Nov | Encryption and Shor's Algorithm | | |
| | 6-Nov | Physical Qubits | Assignment 4 due on 11/9 | |

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| 13 | 11-Nov | Veteran's Day | | |
| | 13-Nov | Physical Qubits | | |
| 14 | 18-Nov | Physical Qubits | | |
| | 20-Nov | Physical Qubits | | Phase 1 Project Due 11/23 |
| 15 | 25-Nov | Physical Qubits | | |
| | 27-Nov | Non-Instructional Day | | |
| 16 | 2-Dec | Physical Qubits | | |
| | 4-Dec | Review | | Phase 2 Project Due 12/7 |
| Final Exam | 16-Dec | Tue, December 16 7:45-9:45 PM | | |