University of Pittsburgh | Dietrich School

Quantum Computing and Quantum Information Certificate

www.PQI.edu
Revised: 10/2022

Overview

The University of Pittsburgh combines the strengths of the Dietrich School of Arts and Sciences (DSAS), Swanson School of Engineering (SSOE), and School of Computing and Information (SCI) to develop the basic competencies needed by science and engineering graduates to contribute to the rapidly growing field of quantum computing and quantum information science and technology in quantum adjacent roles - electronics and electrical engineering, programming, software development, algorithm, linear algebra, vacuum technology, cryogenics, and many other areas. The quantum industries have a growing need for this type of T shaped quantum adjacent workers who have a broad understanding of QIS and are proficient in the area in which they are majoring.

Students can take an Independent Research, Independent Studies, or Capstone course with faculty members across different schools for which they can earn course credit toward this certificate if the topic focuses on quantum. Clear requirements and deadlines for the course must be agreed upon by both the student and faculty mentor Student may take this type of course for one, two, or three credits; if student takes it for fewer than three credits, they can combine such credits across different semesters to fulfil the requirement of a 3-credit course.

Some courses that apply towards the certificate also count as electives in the degree tracks of Chemistry and Physics and Astronomy. No more than nine credits can be earned through those courses.

Requirements

The BS joint Quantum Computing and Quantum Information Certificate (QCQIC) program will consist of a 15-credit requirement (not including any pre-requisites) that must be combined with a BS degree in any discipline in DSAS, SSOE and SCI.

Core courses

Foundations of Quantum Computing and Quantum Information

Elective courses

Students will choose three courses from the following lists of lower-level and upper-level courses.

Quantum related electives

Choose one of the following courses

HPS 1612 (cross-listed as PHIL1612) - Philosophy of 20th-Century Physics
CHEM 1410 Physical Chemistry 1 (Quantum Mechanics) and Physical Chemistry Laboratory 1
or CHEM 1480 Intermediate Physical Chemistry
CHEM 2120 Descriptive Inorganic Chemistry
CHEM 1620 Atoms, Molecules, and Materials
PHYS 0330 Physics and Quantum Computing Seminar (new course in planning)
PHYS 0477 Principles of Modern Physics 1
PHYS 0520 Modern Physical Measurements
PHYS 1370 Quantum Mechanics 1
PHYS 1371 Quantum Mechanics 2
PHYS 1374 Introduction to Solid State Physics
ECE 1232 Introduction to Lasers and Optoelectronics
ECE 1247 Semiconductor Device Theory
ECE 1272 Design and Simulation of Photonic Integrated Circuits
MEMS 1058 Electromagnetic Properties of Materials
ENGR 1066 Introduction to Solar Cells and Nanotechnology
CS 1613 (new Quantum Computing course)
CHEM 1710 Chemistry undergraduate research (if the research is in quantum conducted by a
PQI faculty member)
PHYS 1903 (if the research is in quantum)
ECE 1893 (if the research is in quantum)
CS 1950 Capstone directed research (if the research is in quantum)
CS 1951 Directed research (if the research is in quantum)
INFSCI 1710 Independent research (if the research is in quantum)

Quantum adjacent electives

Choose one of the following courses

HPS 1653 (cross-listed as PHIL1610), Introduction to the Philosophy of Science
CHEM 1420 Physical Chemistry 2 (Statistical Thermodynamics)
CHEM 1000 Mathematics for Chemistry
ENGCMP 0530 Writing for the Sciences (English Department)
PHYS 1341 Thermodynamics and Statistical Physics
PHYS 1351 Intermediate Electricity and Magnetism
PHYS 1361 Wave Motion and Optics
ECE 0301 ECE Problem Solving with C++

ECE 0201 Digital Circuits and Systems (Although quantum logic gates are fundamentally different than digital gates, this is the course where the students first learn the concept of a "logic gate". This can provide students with a baseline of how computers currently work, as a foundation for understanding the concept of "quantum computing")
ECE 1250 Nanotechnology and Nano-Engineering
IE 1081 Operations Research (related to optimization applied to operations)
IE 1082 Probabilistic Methods in Operations Research (stochastic decision modeling techniques)
ENGR 1453: Data Science: Statistical Learning, Modeling, and Prediction
INFSCI 1520 Information Visualization
INFSCI 1530 Data Mining
INFSCI 1470 Immersive Media Technologies
INFSCI 1630 Communication Networks
INFSCI 1640 Wireless Networks
INFSCI 0310 Computation in Info Science
INFSCI 1600 Security and Privacy
INFSCI 0610 Networks and Information
CMPINF 0401 Intermediate Programming
CS 0441 Discrete Structures for Computer Science
CS 0445 Algorithms and Data Structures 1
CS 1501 Algorithms and Data Structures 2
CS 1502 Formal Methods in Computer Science
CS 1510 Algorithm Design
CS 1656 Introduction to Data Science
CS 1675 Introduction to Machine Learning
CS 1678 Introduction to Deep Learning

Capstone

Additional elective courses for the QCQIC will be added to the program as they are developed and become available in the DSAS, SSOE, and SCI (new courses must be approved by the Advisory Committee). Some courses that apply towards the certificate also count as electives in the degree tracks of Chemistry and Physics and Astronomy but no more than 9 credits can be earned through those courses.

Grade Requirements

A minimum GPA of 2.0 is required in each course that counts toward the certificate.

Satisfactory/No Credit Option

There is no limit to the number of courses that can be taken on the S/NC basis for this certificate.

Students interested in the certificate should contact one of the advisors in the Department of Physics and Chemistry.

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