ECSE-4964 and ECSE-6964
Quantum Computer Programming

Mon & Thurs 4:45pm–6:05pm

W. Randolph Franklin

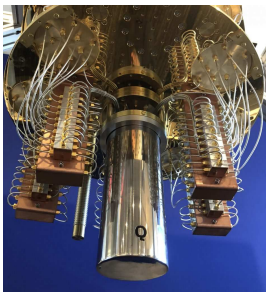frankwr@rpi.edu, https://wrf.ecse.rpi.edu/

Catalog: Intro to quantum mechanics. Various physical realizations of quantum computing, such as transmon qubit (IBM Q), trapped ion (IonQ), and quantum annealing (D-Wave). Quantum states and qubits. Quantum gates including Hadamard, Pauli-XYZ, Toffoli, Fredkin. Qiskit. Quantum algorithms such as Grover, and Shor. Programming quantum computers using IBM qiskit and Microsoft Quantum.

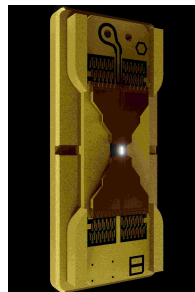**Pre-requisites:** ECSE-2610, CSCI-2200, and PHYS-1200.

Suggested textbooks: 1. Noson S. Yanofsky and Mirco A. Mannucci, Quantum Computing for Computer Scientists, 2008; 2. Abraham Asfaw et al, Learn Quantum Computation using Qiskit, http://community.qiskit.org/textbook, 2020; 3. N. David Mermin, Quantum Computer Science An Introduction, 2006.

6000 course: will also require a research paper and more serious programming on the three platforms
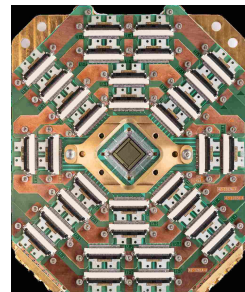
Learning Outcomes: 1. Demonstrate proficiency with the mathematics behind quantum computing. 2. Understand important quantum computing algorithms. 3. Understand the three main quantum platforms: transmon qubit, trapped ion, and quantum annealing. 4. Apply that to write and run programs on those platforms.

IBM

IonQ

D-Wave