EEC289L: Quantum Information Technologies
4 units - Winter 2020, alternate years
M/W 4:10-5:30pm

Prerequisite: required - MAT 022A, desired - any class in PHY 009 series

Grading: Letter; Class Participation 10%, Midterm 30%, Homework 30%, Final Project 30%

Catalog Description: Concepts and formalism of quantum information theory, principles of quantum communication, computing and sensing, physical implementations of quantum information technologies, hands-on programming of a quantum computer on the cloud.

Expanded Course Description:

This course is aimed at graduate students with interest in quantum technologies who have a solid background in linear algebra. The course learning goals aim for students to:

- Become familiar with the unintuitive concepts of quantum mechanics such as the superposition, entanglement, and the no-cloning theorem,
- Command the basics of the Dirac notation (i.e. the mathematical formalism of quantum information),
- Learn the concepts of quantum computing, quantum communication and quantum sensing,
- Understand the operating principles of some of the most prevalent physical implementations of quantum information systems,
- Learn to program in Qiskit open-source quantum computing software development framework,
- Develop interdisciplinary communication and presentation skills.

The lectures will incorporate active learning and student discussions, while the weekly homework will help solidify the understanding of concepts and provide practice in quantum programming. The midterm exam will assess the mastery of the technical material, while the group project will provide an opportunity to delve into a topic of interest, practice teamwork, science communication and presentation skills. The final presentation will consist of a short video and an in-class Q&A session.

Textbook/reading:

1. Nielsen, Michael A., and Isaac L. Chuang. "Quantum Computation and Quantum Information (10th Anniv. Version)." (2010).
2. Abraham Asfaw, Luciano Bello, Yael Ben-Haim, Sergey Bravyi, Lauren Capelluto, Almudena Carrera Vazquez, Jack Ceroni, Jay Gambetta, Shelly Garion, Leron Gil, Salvador De La Puente Gonzalez, David McKay, Zlatko Minev, Paul Nation, Anna Phan, Arthur Rattew, Javad Shabani, John Smolin, Kristan Temme, Madeleine Tod, James Wootton. "Learn Quantum Computation using Qiskit." (August 2019). Retrieved from http://community.qiskit.org/textbook
3. Scientific publications in the field of quantum information technologies

Instructor: Radulaski

Course Overlap: Math 280 overlap on the introduction to the quantum information formalism.