Fall 2026: ELEC 5970/6970
Quantum Information and Computation

Time: Tue/Thu 12:30 - 01:45 pm
Where: Broun Hall 235 and Computer Lab (TBD)
Instructor: Dr. Zihe Gao (zzg0036@auburn.edu)

Prerequisite: Prerequisite: ELEC 2120. (Students from other departments require faculty approval.)

Course Description: This course introduces the principles of quantum information science, quantum computing, communication, and sensing, beginning with the fundamentals of quantum mechanics for students without a physics background. Topics include superposition, entanglement, measurement, quantum algorithms, quantum key distribution (QKD), and quantum sensing..Seven.hands_on.computer.lab.sessions.will.be.held.during. class.in.a.computer.lab¡

Course Outline

- **Part 1 - Foundations of Quantum Mechanics**: Wave-particle duality, superposition, uncertainty, Dirac notation, qubits.
- **Part 2 - Quantum Computing**: Quantum gates, circuits, teleportation, Simon's, Shor's & Grover's algorithms.
- **Part 3 - Quantum Communication & Sensing**: Quantum key distribution (BB84, E91), quantum optics, and quantum metrology.

Tools & Software

- Python (no prior experience required)
- Qiskit (IBM's quantum SDK, free and open-source)

Grading

- Homework and Computer Labs (Math + Coding): 50%
- Quizzes & Concept Checks: 10%
- Midterm Exam: 20%
- Final Project: 20%

Textbooks: [1] Paul Kaye, Raymond Laflamme, and Michele Mosca, An Introduction to Quantum Computing, Oxford University Press (2007). [2] Nielsen, M.A. and Chuang, I.L. (2010). Quantum Computation and Quantum Information (10th anniversary ed.). Cambridge University Press.