EECS 598 2001 TOPICS COVERED IN CLASS

Part I. Introduction
- Brief Overview of Quantum Computing
- Basics of Quantum Mechanics and Mathematical/CS Background (2 lectures)
- Classical vs Quantum: positive and negative results; sample algorithms
- Basic examples of Quantum Circuits: adders, etc
- An overview of implementation technologies and implied constraints

Part II. Classical circuits
- Brute-force Synthesis of Optimal Classical Circuits; Basic Heuristics
- BDD-based Synthesis with Implicit representations
- Basic ideas in circuit testing, ATPG, D-algorithm, redundancies, etc
- Don't cares in classical circuits, SPFDs and related
- Spectral ideas in circuit synthesis
- Fault-tolerance, ECC....
- Reversible circuits

Part III. Quantum Circuits
- The pivotal role of the Fourier transform in quantum computing
- Circuits for the Quantum Fourier transform
- Gate Libraries for Quantum Circuits
- Straighforward synthesis of quantum circuits (following Cybenko)
- Heuristics for minimization of quantum circuits
- Quantum Measurement and don't cares of quantum circuits
- Errors in quantum circuits, fault-tolerance, ECC

Part IV. Simulation of quantum circuits/algorithms
- Notations for quantum circuits and algorithms
- Basic challenges, best-case vs worst-case
- FFT-based and BDD-based simulation

Part V. Research topics explored via student term projects.
Each project will include a written report, a 30-min presentation as well as the design of software or logic circuits.