ENEE789Q Advanced Topics in Electrophysics:

Quantum Optics and Communication

Course Goals:
The course provides understanding of consequences of quantum nature of light to optical communication and computation by introducing the relevant theory and experimental results.

Course Prerequisite:
ENEE 690 or equivalent.

Textbook(s): "Quantum Theory of Light" by Rodney Loudon, and "Introductory Quantum Optics" by Christopher C. Gerry and Peter L. Knight

Reference(s): List of published journal papers will be provided

Core Topics:

- Semi-classical model of interaction of light and atoms
- Classical theory of optical fluctuations and coherence
- Quantization of the radiation field and interaction with atoms
- Chaotic light, number states, coherent states, squeezed states
- Beam-splitter input-output relations, Mach-Zehnder interferometer
- Quantum degrees of first and second order coherence
- Quantum theory of direct detection
- Coherent detection: homodyne and heterodyne
- Phase-insensitive and phase-sensitive amplification
- Quantum information and channel capacity
- EPR paradox, Bell's inequality and quantum cryptography

Optional Topics:

- Quantum theory of laser phase and amplitude fluctuations
- Quantum detection and Helstrom bound
- Quantum computation

Course Structure:

There will be two lectures per week.
Weekly homework and reading assignments.