ELEN 527 — Optical Communication Systems

Overview:

Optical telecommunication system performance issues and enabling technologies.
Shot noise mitigation, dispersion compensation, reduction and exploitation of nonlinearities.
Raman fiber amplifiers and EDFAs, microstructured fiber, all-optical pulse regenerators, FBGs.
Optical sources and detectors for current and next generation systems. DFB lasers. Fiber ring resonators for next-grid frequency comb generation. Super-continuum generation in photonic crystal fiber. PIN and avalanche photodetectors. Coherent detectors and systems.

Topics will include:

Optical impairments and their mitigation
Squeezed-states for performance beyond the "shot noise limit." Budget calculations to deal with cross-talk induced by nonlinearities such as four-wave mixing, self-phase and cross-phase modulation, stimulated Brillouin and Raman scattering. Dispersion compensation via DCFs, fiber Bragg gratings and photonic crystal fiber for dispersion engineering.

State of the art technologies and networks
Raman fiber amplifiers, EDFAs and SOAs. DFB lasers. PIN and avalanche photodetectors. Reconfigurable optical networks. ROADM. PONs. DWDM vs OTDM architectures. FTTx.

Next generation optical networks and technologies
Optical packet and burst switching. Soliton systems. Next generation transmission windows. Optical sources and detectors for next generation systems. Super-continuum generation in photonic crystal fiber. Fiber ring resonators for next-grid frequency comb generation. OFDM and coherent heterodyne detectors. Frequency conversion devices. All-optical pulse regenerators.

Course grading:

There will be two exams (each at 30% of the course grade) and a research report (also at 30%). Although the homework only comprises 10% of the course grade, these are imperative since they provide the problem solving practice necessary for learning, and hence doing well on the exams. The research report will be similar to a term paper, in the sense that it will involve some reading of technical literature and the writing of a brief report. The research report will differ from a term paper, in that it will also involve some type of calculation or simulation. The required calculation or simulation can range from: calculating a nonlinearity budget for any current (or future) optical network; to running existing simulation software to produce a dispersion margin estimate.

Midterm Exam	30%
Final Exam	30%
Homework	10%
Research Report	30%