Syllabus for EEL 4440 (Fall 2005)

Title: Optical Communication Systems (3 credits)

Instructor: Professor Huikai Xie
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Course description:
Introduction to optical waveguides and fibers, propagation characteristics of fibers, characterization methods, LEDs, laser diodes, optical receivers, optical amplifiers, all-optical switching and fiber optic communication systems. The objective is to give students a comprehensive understanding of the fundamentals of the operation and design of fiber optic systems and components employed in such communication systems.

Prerequisites: EEL 3396 or equivalent

Textbook:

Topics:
- Overview of fiberoptic communication systems: evolution, nature of light, advantages and applications
- Optics Review: Ray theory, lenses, imaging, numerical aperture, diffraction
- Lightwave fundamentals: introduction to electromagnetic waves, wave equations, group velocity, dispersion, polarization, resonant cavities, total internal reflection
- Integrated optic waveguides: dielectric-slab waveguide, modes, coupling, dispersion, integration
- Optic fibers: step-index fibers, graded-index fibers, modes and fields in fibers, pulse broadening and information rate, fiber fabrication and characterization
- Optical sources and amplifiers: PN junction, LEDs, laser principles, laser diodes, tunable laser diodes, VCSELs, modulation, optical amplifiers
- Optical receivers: photomultipliers, photodiodes, APDs, responsivity, quantum efficiency, noise, heterodyne detection, preamplifiers
- WDM concepts and components: WDM principles, N N couplers, star couplers, add/drop multiplexers, fiber grating filters, tunable sources, and tunable filters.
- All optical-switching: advantages, MEMS introduction, optical MEMS devices for optical switching

Laboratory: 2 one-hour lab tours to become familiar with components used in optical communication systems

Grading: Homework: 15%; Lab: 5%; 3 Tests: 40% (20% each, drop the lowest score); and Final Exam: 40%.

Reference books: