ECE 162C: PROBLEM SET #2

DUE WEDNESDAY, APRIL 16, 2008

PROBLEMS:

1. Derive an expression for the confinement factor Γ of single mode fibers defined as the fraction of the total mode power contained inside the core . Use the Gaussian approximation for the fundamental fiber mode. Estimate Γ for V=2.

2. A 1.55 micron Gaussian pulse of 100 ps width (FWHM) is launched into a single mode fiber. Calculate its FWHM after 50 km if the fiber has a dispersion of 16 ps/(km-nm). Neglect the source spectral width.

3. A step index multimode fiber with a 50 μm core diameter is designed to limit the intermodal dispersion to D=10 ns/km. What is the numerical aperture of this fiber? Use a group index of refraction of 1.45.

4. Problem 2.14

5. Sketch the maximum distance of propagation (i.e. the loss and dispersion limits) for the first 4 major fiber optic revolutions:
   1. GaAs lasers, multimode fiber, multimode lasers
   2. 1.3 micron InGaAsP lasers, multimode fiber
   3. 1.3 micron InGaAsP lasers, single mode fiber
   4. 1.5 micron InGaAsP lasers, single mode dispersion compensated fiber

   State the assumptions you make about the spectral width of the sources.