

ENEE 691

Problem Set #2

Due February 26, 2002

- (1) Calculate and plot the waveguide dispersion curves for a slab waveguide with $n_1=4$, $n_2=2$, $2d=1.0\mu\text{m}$. these are unrealistic values for an actual slab waveguide, but they make the calculations and the dispersion curves easier to plot. Plot these dispersion curves for the $m=0,2,4,6$ and $m=1,3,5$ modes. An example is given in Fig. (17.10) of Lasers and Electro-Optics by Davis.
- (2) Calculate and plot the transverse intensity patterns of an HE_{11} mode in a cylindrical, step-index fiber with $n_1=1.5$, $n_2=1.485$, $a=2\mu\text{m}$. Choose an input wavelength that is 1.5 times the cutoff wavelength for the fiber to be single mode.
- (3) Fit the profile calculated in Problem (2) to a Gaussian function and plot both curves to show the closeness of the fit.
- (4) Calculate how many modes will propagate in fibers of core diameters $10\mu\text{m}$ and $50\mu\text{m}$, respectively, when they are coupled to sources with wavelengths $1.55\mu\text{m}$ and $0.85\mu\text{m}$. Taken $n_{\text{core}} = 1.465$, $n_{\text{cladding}}=1.46$.
- (5) Calculate the waveguide parameter β for the HE_{11} , HE_{21} , and TE_{01} modes in the two fibers in problem (4) for the two wavelengths mentioned.