Due: Tuesday Oct. 1, in Class.

Read: Ch. 1, 2.1, 2.2.1, 2.2.2*, 2.2.3, 2.5.1

Problems:

1. Consider a step-index fiber which has a core refractive index of 1.495. What is the maximum refractive index of the cladding in order for light entering the fiber at an angle of 60 degrees to propagate through the fiber? Air has refractive index of 1.0.

2. Find the numerical aperture in a graded-index fiber with two layers shown in Fig. 2. Compare the answer with the numerical aperture of the step-index fiber shown in Fig. 1. Can we use geometric optics to deal with situations where the wavelength and core diameter are of the same order of magnitude (e.g., single-mode fiber)?

3. Consider a step-index multimode fiber in which the refractive index of the cladding and core are 1.35 and 1.4, respectively. The diameter of the core is 50 μm. Approximately how many modes are supported by the fiber for a signal at a wavelength of 1550 nm?

4. Find the approximate number of modes in a 100 μm core step-index multimode fiber at 850 nm. Assume the refractive index of the core to be 1.5 and that of the cladding to be 1.47.

5. Consider an optical link in which power at the transmitter is 0.1 mW and the minimum power required at the receiver is 0.08 mW. The attenuation constant for the fiber material is 0.033 dB/km. What is the maximum length of the optical link, assuming that there are no amplifiers?